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INSTRUCTION MANUAL

DOVETRON MPC-1000CR REGENERATIVE

RTTY TERMINAL UNIT

MULTIPATH CORRECTION

SIGNAL REGENERATION - SPEED CONVERSION

DIGITAL AUTOSTART

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MPC-1000CR.500 and up.

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MPC-1000CR Regenerative RTTY Terminal Unit

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MPC-1000CR REGENERATIVE RTTY TERMINAL UNIT

DESCRIPTION

The DOVETRON MPC-1000CR is a Signal Regenerating, Speed-Converting, In-Band Diversity RTTY Terminal Unit that features Multipath Correction, a high level keyer and an internal loop supply.

The Polar data Inputs and Outputs are available in two low-level configurations (EIA and MIL).

The input Mark and Space channels are continuously variable from 1200 Hz to 3100 Hz. Other frequency ranges are available.

The Regenerator Section consists of a Dovetron TSR-200D, which may be operator-programmed for 5, 6, 7 or 8 level codes, with 1.0 or 1.5 CU structure. Parity is also selectable.

A front panel Signal Speed switch selects 45.45, 50.0, 56.88, 74.2 (75.0) or 110 Baud communication baud rates.

The Loop output baud rate may be programmed internally to a fixed speed, permitting up-down Speed Conversion in the Half-Duplex mode.

The MPC-1000CR provides nominal loop currents of 20, 40 or 60 milliamperes. A rear panel Loop Adjustment potentiometer is provided to set loop currents precisely.

Programming instructions of all switches are etched right on the printed circuit boards.

The audio input is transformer coupled and has a nominal 600 impedance.

The Mark and Space tone frequencies are phase-continuous and continuously adjustable from the rear panel over a range of 1200 Hz to 3100 Hz. Nominal output is Ø dbm.

Rear panel connectors provide Dual-Diversity operation of two or more Dovetron terminal units without the need for an external comparator unit.

Additional connectors permit interconnecting a Dovetron SCR-1000 Selective Calling-Recognition unit.

Three remote control lines are provided, which are part of an isolated deck on the front panel ON-STANDBY switch. On some units, this switch is labeled REC-SEND. When supplied with Spanish front panels, this switch is labeled: REC-TRANS.

Two rear panel fuses are provided for the Power and Loop power circuits.

A Third fuse is mounted under the main board and protects the CRT's high voltage power supply.

This manual is complete when the following prints are attached:

75100: Assembly Main Board, E-Series.

75103: Schematic Main Board, E.Series.

75164: Schematic TSR-200D Regenerator.

75171: Assembly TSR-200D Regenerator.

ORGANIZATION

The MPC-1000CR consists of two basic, easy to identify sections:

1) Main Board A75100-E.

2) TSR-200D Signal Regenerator Assembly.

Each Section consists of a separate printed circuit board and associated wiring and external components.

MAIN BOARD A75100-E

The main board assembly is the same as that used in the MPC-1000C RTTY Terminal Unit.

It is thoroughly discussed and detailed in the rear section of this manual, pages 1 thru 58.

TSR-200D SIGNAL REGENERATOR ASSEMBLY

The TSR-200D assembly consists of four sections:

1) Signal Regenerator (UART).

2) Dual Crystal-Controlled Clock.

3) Bilateral Steering Circuits.

4) Character Recognition-Speed Determination Digital Autostart circuit.

SIGNAL REGENERATOR

The Signal Regenerator section regenerates all signals passing thru it to less than 0.5% bias distortion, significantly reducing the error rate of the RTTY communication system.

When used in Half-Duplex operation, both the incoming and outgoing signals are processed thru the Regenerator. Since the TSR-200D is a half-duplex device, it must be switched between Transmit and Receive by the front panel ON(Receive)-STANDBY (Send) switch or by the rear panel remote LOCK line.

Signal Regeneration is accomplished by an Intersil IM6402CPL CMOS 40-pin UART (Universal Asynchronous Receiver/Transmitter) located at Z2. This UART is a dual chip. One half is a Serial/parallel converter and the other half is a parallel/serial converter.

Although both sides of this UART are programmed simultaneously by the UART Program Switch S3, they have separate clock input ports. When a single clock is used at both ports, straight-thru regeneration is achieved, i.e., no change in baud rate.

If the Speed Conversion Switch S5 is set to ON, the two sides of the UART can be clocked at different baud rates, providing up/down Speed Conversion.

Since the UART contains only a single character of Memory, the Output Clock (Loop) should always be set as fast or faster than the Input Clock to prevent character over-runs.

Speed Conversion is convenient if the local teleprinter is set for 100 WPM, because the front panel switch may be used to select slower incoming baud rates, which will be up-converted by the UART to 100 WPM. The UART in this mode of operation is an effective electronic gear shift.

DUAL CRYSTAL-CONTROLLED CLOCK

The Dual Clock circuitry consists of a CMOS oscillator (Z1) and a very low frequency crystal (60.000 KHz), whose output is divided by two identical frequency dividers: Z7/Z8 and Z9/Z10.

When the Speed Convert switch (S5) on the TSR-200D assembly is OFF, both sides of the UART regenerator are driven by the output of Clock 1 Divider, which is controlled by the front panel Signal Speed select switch.

If this switch is set to 75 bauds, an incoming signal will be processed thru the UART at 75 bauds.

If the Speed Convert switch is set to ON, the Signal Speed switch will select the input baud rate (baud rate of the incoming signal) and the 8-pole DIP switch (S2) will select the baud rate at which the regenerated signal will be clocked out of the UART and sent to the local teleprinter.

This output clock may be programmed for baud rates from 37.5 bauds to 3750 bauds. Poles 1 thru 4 represent the Most Significant Digit (MSD) and Poles 5 thru 8 represent the Least Significant Digit (LSD). The BCD weight of each switch pole is etched on the PC board just below the switch.

Assuming that the local teleprinter is geared for 100 WPM (74.2 or 75 baud operation), S2 must be programmed for 75 Baud operation.

To determine the proper divisor number for a baud rate, use the following formulae:

1) BAUD RATE X 16 = CLOCK FREQUENCY (HZ).

2) 60,000/CLOCK FREQUENCY = DIVISOR.

Example: 75 Baud X 16 = 1200 Hz. $\frac{60,000}{1200} = 50.$

Therefore, if S2 is programmed with a divisor (BCD number) 50, the frequency dividers of Clock 2 will divide the 60.000 KHZ oscillator signal down to 1200 Hz, and the UART will output the regenerated signal at 75 Bauds.

BILATERAL STEERING CIRCUIT

When used in the Half-Duplex mode, the two clocks are inverted when the terminal unit is switched between Receive and Send, which permits effective Speed Conversion of both incoming and outgoing signals. If the UART is up-converting in Receive, it will be down-converting in Send.

This switching of Input and Output ports of the UART and the automatic inversion of the two clocks is accomplished by the Bilateral Steering Circuit, which consists of Z3, Z4, Z5 and Z6.

UART PROGRAMMING

The UART may be programmed for various code levels and functions.

Assuming that the MPC-1000CR is to be used for Radio TTY communications with the 5 level Baudot (Murray) code, program the UART via the 8-pole DIP switch at S3:

SWITCH POLE	FUNCTION	MODE	SWITCH POSITION
8	EPS	ZERO	LEFT
7	SBR	NO	LEFT
6	NB1	ZERO	LEFT
5	NB2	ZERO	LEFT
4	TSB	ONE	LEFT
3	SP CAL	OFF	RIGHT
2	PARITY	NO	LEFT
1	FSK	EIA	LEFT

If other coding is desired, the UART may be re-programmed per the coding charts on the TSR-200D Schematic Print 75164.

UART OPTIONS

STOP BIT REQUIRED (SBR): Normally it is best to leave this function in the NO position. There is no reason to force the UART to dump a good character just because the Stop Bit was not detected on the incoming signal. Since all languages are highly redundant in structure, it is always better to print a character, even if it is wrong. The precise Stop Bit generated at the end of each regenerated character will prevent the local teleprinter from losing signal sychronization.

TOTAL STOP BITS (TSB): The UART offers the option of attaching a 1.0 or 1.5 Character Unit stop bit to the end of the regenerated character. Selecting a 1.0 CU stop bit guarantees no character over-runs with Baudot teleprinters operating with 7.0, 7.42 and 7.5 CU coding.

PARITY & EPS: Baudot Coding does not require Parity, so Pole 2 of the UART Program Switch should be set to NO (LEFT). With Parity set to NO, ESP has no function, so Pole 8 can be left in either position.

SPACE CAL (SP CAL): It is the nature of a UART to always set high, that is MARK. Pole 3 permits the UART's output to be forced low for calibration purposes.

TEST POINTS

Seven Test Points have been provided on the TSR-200D assembly to assist in rapid signal tracing and trouble shooting:

TP-1: CRYSTAL OSCILLATOR OUTPUT

The oscillator circuit is comprised of a Statek quartz crystal, sealed in a gold-plated TO-5 type can and a CMOS 14007 DIP package. It is not unusual for this type of oscillator to take up to four seconds to start oscillating after initial turn-on. The nominal frequency of this crystal is 60.000 KHz ±0.05%.

TP-2: CLOCK 1 OUTPUT

The frequency at TP-2 is the 60 KHz clock divided by the Signal Speed Select dividers (Z7 and Z8). If the Signal Speed switch (S1) is set for a division of 82 (45.45 Baud), the output frequency will be 60,000/82 = 732 Hz.

TP-3: CLOCK 2 OUTPUT

The frequency at TP-3 is the 60 KHz clock divided by

the Loop Speed Select dividers (Z9 and Z10). If the Loop Speed Switch (S2) is set for a division of 50 (74.2/75 Baud), the output frequency will be 60,000/50 = 1200 Hz.

TP-4: UART INPUT CLOCK

The frequency at TP-4 is the Input Clock to the UART at the output of the bilateral steering section. In Receive, it is Clock 1 and in Transmit, it is Clock 2.

TP-5: UART OUTPUT CLOCK

The frequency at TP-5 is the Output Clock to the UART at the output of the bilateral steering section. In Receive, it is Clock 2 and in Transmit, it is Clock 1.

TP-6: UART DATA INPUT

This test point is the same as Pin 20 on the UART, which is the DATA INPUT port. In Receive, it contains the unregenerated signal from Q6 (loop driver) in the MPC, and in Transmit, it contains the unregenerated signal as originated at the local teleprinter, TD, etc.

TP-7: UART DATA OUTPUT

This test point is the same as Pin 25 on the UART, which is the DATA OUTPUT port. In Receive, it contains the regenerated (and possibly speed-converted) data signal that is routed to the high level keyers. In Transmit, it contains the regenerated signal as generated by the local teleprinter.

DIGITAL AUTOSTART

Most terminal units utilize an analog form of autostart that is known as MARK Autostart. It responds to any amplitude energy in the Mark filter of the terminal unit. For this reason, it is susceptible to false starts caused by SSB, CW, noise crashes, static and swish-thru carriers. It does not respond to energy in the Space channel.

In addition to Mark autostart, all Dovetron terminal units offer a second form of analog autostart: FSK Autostart. This type of autostart ignores constant amplitude energy in either the Mark or Space channel, but responds to changes in amplitude in either channel. It is a very useful autostart system when the transmitting station maintains a "marking" carier for long periods of time. It permits the terminal unit to "time-out" the teleprinter during those long periods of inactivity.

A complete description of these autostart forms is contained in the MPC-1000C section of this manual, pages 21 and 22.

A third form of autostart is available in the MPC-1000CR: Digital Autostart (DAS).

The DAS circuitry is located on the TSR-200D assembly and consists of Z11, Z12 and their associated components.

This unique circuit monitors the contents of the UART's parallel output register. Whenever it senses a Space Character, which is configured in the Baudot Code as SPACE-SPACE-MARK-SPACE-SPACE, is generates a logic 1 to the Autostart circuitry on the main board, enabling the autostart relay K1.

The Digital Autostart circuit is always connected to the MPC-1000CR autostart circuit, but in the MARK and FSK positions of the Autostart Select switch, is over-ridden by either the MARK or FSK Autostart commands. When the Autostart Select switch is in the DIGITAL position, the MARK and FSK modes are disconnected and the DIGITAL Autostart functions as the sole control source.

Both Character Recognition and Speed Determination are accomplished in the DAS, because Baudot characters sent at speeds other than what the UART has been set for, do not generate the necessary Mark/Space bit combinations to duplicate a Space Character.

If the front panel Signal Speed switch is set for 45.45 baud operation, a Space Character will not be detected if the incoming signal is operating at 56.88, 74.2 or 75 bauds, and probably not at 50.00 bauds. The latter depends somewhat on the amount of bias distortion on the incoming signal, etc.

If the baud rate is correct, but the signal inverted, the FIGS character will duplicate the coding of a Space Character but generally not often enough to enable the Digital Autostart Threshold.

The Threshold of the DAS is set by R53 on the TSR-200D assembly.

Although this form of Digital Autostart is not Selective Calling, it may be used in a Selective Calling mode by setting the Turn-On threshold to mid-scale or above, requiring the initial receipt of 10 or more consecutive Space Characters to achieve Turn-On.

Statistically, the Space Character will be generated at random by static and noise crashes. If the Threshold is set too low, one of these noise pulse combinations may load the output register of the UART with a SPACE-SPACE-MARK-SPACE-SPACE combination and "fake" the DAS into a false start. The next noise crash

will change this coding in the UART's output register and the DAS will proceed to Time-Out and turn off.

If by chance only one noise crash came thru and duplicated the Space Character, the teleprinter would be turned on and left on, as long as the Space Character was in the UART's output register. But with no other noise crashes coming thru, the printer will stay idle and not print garble.

Either way, the Digital Autostart performs its function in a much superior way to any analog form of autostart.

CALIBRATION PROCEDURE

MAIN BOARD CALIBRATION

The calibration procedures in the MPC-1000C Section of this manual should be followed for calibrating the main board of the MPC-1000CR.

AFSK TONE KEYER CALIBRATION

If the TSR-200D Regenerator is turned off at S4 on the TSR-200D assembly, the Mark and Space tones may be calibrated per the main board section.

Another and easier approach, with the TSR-200D turned on, is to switch Pole 1 of the UART Program Switch S3 from EIA to MIL (or vice-versa), which will invert the tones.

After calibration of the second tone, remember to put S3 back in its original position.

TSR-200D REGENERATOR TESTS

Check the crystal oscillator for an output of 60.000 KHz ±5 Hz at TP1.

Check Clock 1 output frequency at TP2. The output frequency will be determined by the setting of the front panel Signal Speed Select Switch:

45 Baud	732 Hz.
50 Baud	800 Hz.
57 Baud	910 Hz.
75 Baud	1200 Hz.
110 Baud (ASCII)	1765 Hz.

These frequencies will have an accuracy of ±1 Hz.

Check Clock 2 output frequency at TP3.

The frequency will be determined by the setting of the 8-pole DIP switch located at S2, and will be identical to the frequencies listed above.

To check various frequencies, remember that the frequency at TP3 is determined by the following formula:

$$\frac{60,000}{\text{BCD DIVISOR SET IN S2}}$$

DOVETRON

MPC-1000R/TSR-500D, MPC-1000R/TSR-200D & BASIC-R

The standard configuration of the MPC-1000R contains a TSR-500D Signal Regeneration-Speed Conversion board and a DAS-100 Digital Autostart Module. The MPC-1000R manual fully details this configuration.

The MPC-1000R/TSR-200D version has the TSR-500D assembly replaced by a TSR-Adapter and a TSR-200D Signal Regeneration-Speed Conversion board. Digital Autostart (DAS) is also available in this version.

A short (2 inch) cable interconnects the TSR-Adapter and the TSR-200D.

The cables from the front panel Signal and Loop speed switches plug into the TSR-200D. The Memory Function switches are not functional, since the TSR-200D does not contain a Memory Section.

The Memory Empty LED is forced ON by a 1K resistor installed in location R2 on the TSR-Adapter board.

The DAS of the TSR-200D may be connected to the MPC-1000R's main board in one of the following manners:

1) The blue wire in the J2 logic cable (MPC-1000R) is disconnected from the rear panel TD INHIBIT connector and reconnected to the feed thru hole directly in front of C57 filter capacitor on the main board.

2) This same blue wire might be connected to a feedthru hole in the middle of the terminal unit that is electrically connected to the feed thru hole in front of C57.

3) A short wire may be installed between the DAS E-point on the TSR-200D board and the feed thru holes mentioned in 1 and 2 above.

The manual for the MPC-1000R/TSR-200D consists of a standard MPC-1000R manual plus the Regeneration section of the MPC-1000CR manual.

When configured as a MPC-1000R/TSR-200D, the rear panel REGEN ON-OFF switch must be in the ON (UP) position to enable the TSR-200D assembly, and the Signal Regeneration switch on the TSR-200D must be in the ON position.

The BASIC-R version of the MPC-1000R contains only the TSR-Adapter board. This board is used primarily to secure the internal cables and lock on the Memory Empty LED. The front panel speed switches and the Memory Function switches are inoperative.

The TSR-Adapter board is removed when the TSR-500D is installed. To install the TSR-200D a short cable is required to interface the TSR-200D and the TSR-Adapter.

The manual for the BASIC-R is the standard MPC-1000R/TSR-500D manual.

The rear panel REGEN ON-OFF switch of the Basic-R should be in the OFF (Down) position.

INSTRUCTION MANUAL

DOVETRON MPC-1000R

TSR-500D/DAS-100

REGENERATIVE RTTY TERMINAL UNIT

DIGITAL AUTOSTART

E-SERIES

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MPC-1000R.400 and up.

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PREFACE

The Dovetron MPC-1000R Regenerative RTTY Terminal Unit normally consists of an E-Series Main Frame (Board Number A75100A-E), a TMS-100 AFSK Tri-Mode Tone Selector Assembly, a TSR-500D Signal Regenerator Board and a DAS-100 Digital Autostart Module.

When supplied with the TSR-500D/DAS-100 combination, the terminal unit provides Signal Regeneration, Speed Conversion with a 200 Character FIFO Buffer Memory, Keyboard-Controlled Word Correction and Digital Autostart.

The MPC-1000R is also available as a BASIC-R with a TSR Adapter (75156) which replaces the TSR-500D assembly, and functions as an MPC-1000C with a TMS-100 Tri-Mode Tone Selector.

If a TID-100 Station Identifier board is factory installed, it is mounted underneath the appropriate TSR assembly.

The KOS-100 Keyboard Operated Send option (if installed) is usually used in conjunction with a TID-100 assembly and is mounted underneath the TID-100.

A SCL-100 Selective Calling module may be plugged directly into the TSR-500D assembly for Sel Cal functions.

A PKC-100 Polar Keyer option is also available for use with Polar (double current) teleprinters.

With a TSR Adapter installed, the front panel Memory Empty LED is always lit and the Memory Function and Speed Selection switches are inoperative.

With the TSR-200D/TSR Adapter combination installed, the Signal and Loop Speed switches select the input and output baud rates of the TSR-200D Regenerator assembly.

The front section of this manual details the digital section (TSR-500D) of the terminal unit and the rear section (which is an MPC-1000C manual) details the mainboard section.

In case of conflict between the front and rear section of the manual, the information provided in the TSR-500D section should be considered correct.

OPERATING HINTS

MPC-1000R and TSR-500D

For the operator who prefers to turn on a new piece of equipment and read the manual later, the following is offered:

1) Remove the top lid and inspect the large-scale (LSI) integrated circuits and the four inter-connecting cables for a firm fit in their sockets. It is not unusual for transportation vibration to loosen them in their sockets.

2) Set the rear panel LOOP adjustment pot to midscale and check that the REGEN ON-OFF switch is in the ON position (UP).

3) Attach the power cord, teleprinter's loop line and an audio line from the receiver.

   A) Power cord should be grounded for safety and maximum performance.

   B) Teleprinter's loop line should NOT be grounded thru either loop jack. The teleprinter's loop line must be floating. If a three-way plug with a shield is used, insert it into the rear panel loop connector marked: 3-Way. The shield may be grounded to the terminal unit's cabinet.

   C) The input impedance of the MPC-1000R is 600 ohms, but the terminal unit may be driven with low impedance speaker audio lines, provided the audio is turned up high enough. Many receivers have phone patch or anti-vox outputs, which are usually in the 500 to 2500 ohm region and they make ideal audio sources for the terminal unit.

4) Place all the front panel toggle switches UP, except the Autostart/Motor Control switch. Place it in the Motor ON position.

5) Set the LEVEL control to 9 o'clock and the THRESHOLD control to 12 o'clock.

6) Set the MODE switch to MS, which is the proper position for normal In-Band Diversity operation.

7) Adjust the Mark and Space VFOs to the desired tone frequencies.

8) Set the SIGNAL Speed Switch to the anticipated speed of the incoming signal.

9) Set the LOOP Speed Switch to the speed of the local teleprinter. (45 Baud = 60 WPM, 75 Baud = 100 WPM, etc.)

10) Tune in a known RTTY signal, peaking the Mark and Space VFOs for maximum amplitude of the horizontal and vertical CRT traces and start copying. If the copy is garbled, reverse the NORMAL/REVERSE switch.

11) Now sit back and read the rest of this manual and discover how easy it is to implement all the operating features and functions.

COMMON QUESTIONS

HOW DO I SEND A BLANK CHARACTER OVER THE AIR TO COMPLETE A WRU SEQUENCE IF THE WORD CORRECTION CIRCUIT IS GOING TO ERASE WITH EACH BLANK CHARACTER RECEIVED?

Press the UNLOAD button down, which will turn ON the Memory Full LED and momentarily turn OFF (for about 20 seconds) the Word Correction circuit and let a Blank character be transmitted without erasing the Word Sortage FIFO section of the memory.

HOW CAN I SHORTEN THE TD INHIBIT TIME DELAY?

Locate R76 (22 Meg) and R77 (9 Meg) on the TSR-500D board. These two resistors are in series (31 Meg) and provide the standard time delay. Jumpering of either resistor will shorten the time delay period.

WHEN THE TU IS FIRST TURNED ON, AND THE MEMORY IS CLEARED, THE MEMORY EMPTY LED CONTINUES TO FLASH FOR ABOUT FOUR SECONDS. IS THIS NORMAL?

When first powered-up (turned on), some TID-100 CW IDers will sequence thru their coded program one time. The flashing you see at turn-on with a cleared Memory is the CW ID being sent by the TID-100.

HOW CAN I PROGRAM A TWO-LINE CQ INTO MEMORY AND THEN GET IT TO RECIRCULATE AT MACHINE SPEED RATHER THAN AT THE SLOWER CHARACTER RATE SPEED THAT I HAVE PRESET WITH THE REAR PANEL POT?

If you have preloaded less than 160 characters into the memory, it is going to recirculate at the slower character rate. You can force it to machine speed by depressing the UNLOAD switch. After about 20 seconds, it will slow back down to the slower character rate. To keep it at machine speed during Recirculation, load in the message (two lines), and if the Memory Full LED has not come on (indicating 160 or more characters in storage), depress the UNLOAD switch (forcing the Memory Full LED ON) and load in about 10 Blank characters from the keyboard. This will top-off the memory with at least 160 characters and it will then recirculate continuously at machine speed.

THE MPC-1000R UP-CONVERTS JUST FINE ON RECEIVE, BUT I CANNOT GET DOWN-SPEED CONVERSION WHEN IN SEND. I AM FSKING MY TRANSMITTER (NOT AFSK) AND USING THE EIA (RS232C) FSK OUTPUT ON THE BACK OF THE TERMINAL UNIT.

There are three different FSK outputs available at the rear panel.

1) EIA RS232C (Mark -12V and Space +12V)

2) MIL STD 188C (Mark +6V and Space -6V)

3) REGEN FSK (Mark +12V and Space -12V)

The EIA and MIL FSK outputs are regenerated (and speed-converted) only during Receive. They have been provided for interfacing to video display units and low level typing units.

The REGEN FSK output is the regenerated and speed-converted output of the TSR-500D Regenerator and is jumpered internally to the input of the AFSK Tone Keyer.

IS THERE ANY CONVENIENT WAY TO SET THE VARIABLE CHARACTER RATE POT AT THE REAR PANEL FOR MY PREFERRED TRANSMITTING SPEED?

Set Pole 2 of S3 on the TSR-500D board to the right, enabling the Phasing Pulse (Blank Diddle). Put the Memory Control switch in Recirculate, the terminal unit into Send and Clear the Memory. The local teleprinter will not cycle thru Blanks and the rear panel Character Rate pot may be adjusted to your preferred output speed.

WHEN I SWITCH THE MODE-SWITCH TO MS-REV (RY GENERATOR), ALL I GET IS A STRING OF Ys. WHY DON'T I PRINT RYs LOCALLY?

A string of Mark-Space Reversals (MS-REV) by definition never has two sequential Space bits, so the UART Regenerators will never translate out a letter R, whose first bit is always a Space following the Start Bit which is also a Space Bit. If the receiving station is not using a UART regenerator ahead of the teleprinter, it will print RYs, if the RY speed control R163 on the main board is set properly.

MAYBE ONCE A WEEK, THE DIGITAL AUTOSTART PERMITS THE TELEPRINTER'S MOTOR TO START AND RUN FOR A PERIOD OF TIME BEFORE AUTOMATICALLY TURNING OFF. WHAT IS HAPPENING?

If a random noise crash or static burst just happens to load a Space Character, this Space Character will be held in the output register of the UART and the Digital Autostart circuit will sense this and turn on the teleprinter. The next noise crash (which may not happen for a long period of time) will load a different character and the Digital Autostart will then start to time out. During this period of printer Turn-On, the printer will not print garble, because if another noise crash were received, the output register of the UART would have had the Space Character replaced with another character.

IS THERE AN EASY WAY TO REMOTE CONTROL THE SEND-RECEIVE FUNCTION OF THE TERMINAL UNIT WITH JUST A REMOTE SWITCH TO GROUND?

The +15 VDC Regulated that is supplied to the rear panel connector is current limited. It can be jumpered right into the LOCK connector with a second wire going to your remote switch. When the switch is ground (closed), the +15 VDC will be pulled to ground and the TU will be in Receive. When the switch is open, the +15 VDC will put the TU into Send. Remember that the front panel Send-Receive switch must be in Receive when using remote control.

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MPC-1000R REGENERATIVE RTTY TERMINAL UNIT

SECTION I - DESCRIPTION

The MPC-1000R Regenerative RTTY Terminal Unit is basically an MPC-1000C Multipath-Diversity RTTY Terminal Unit with a TSR-500D Teleprinter Speed Converter-Regenerator mounted internally to provide Signal Regeneration, Speed Conversion, up to 200 characters of Silastic Buffer Storage and keyboard-controlled Word Correction.

The front panel contains switches for basic control of the regeneration, speed conversion and memory exercising functions.

Rear panel connectors permit remote control of the other functions, such as Phasing On-Off, Word Erase, etc.

The Word Correction function is automatic and keyboard-controlled via internal circuitry that is capable of recognizing the SPACE and BLANK characters generated by the local teleprinter.

In addition, the MPC-1000R contains a TMS-100 Tri-Mode AFSK Tone Selector assembly, which permits front panel selection of one of three different Mark-Space-Shift combinations that have been preset for the AFSK Tone Keyer.

All other front panel controls perform in the same manner as their counter parts on the MPC-1000C.

For this reason, the E-Series manual for the MPC-1000C pertains to the MPC-1000R unless specifically noted in the following paragraphs or on the accompanying MPC-1000R prints and schematics.

When the rear panel REGEN ON-OFF switch is in the OFF position, the TSR-500D Regenerator assembly is inhibited, and the MPC-1000R functions as an MPC-1000C. With this switch OFF, the TSR-500D may be removed for service and the terminal unit continued to be used as a non-regenerating modem.

When the REGEN ON-OFF switch is in the ON position, all incoming and outgoing signals (except Mark-Space Reversals from the RY Generator) are regenerated to less than 0.5% bias distortion.

Since the input and output baud rates of the Regenerator may be controlled by the front panel speed switches, and may be set to different speeds, the Regenerator section may also be used as a simultaneous up-down speed converter.

A silastic buffer storage section prevents character over-runs during Down-Speed Conversion, and may be Preloaded and Recirculated.

This buffer memory section consists of five 40 character FIFO buffer elements for a total storage of 200 characters.

SECTION II - THEORY OF OPERATION

The TSR-500D Teleprinter Speed Converter-Regenerator is a digital device that performs Signal Regeneration, Up-Down Speed Conversion, Buffer Storage, Word Correction, Phasing Pulse Generation (BLANK or LTRS) and Variable Character Rate Control.

These functions are accomplished thru the use of a pair of Universal Asynchronous Receiver/Transmitters (UARTs), First-in First-out (FIFO) Silastic memory chips, a crystal-controlled oscillator and various logic and switching elements.

The crystal-controlled oscillator operates at 60 KHz and uses a tuning-fork type piezoelectric quartz crystal.

The output of this oscillator is divided down by two separate BCD/N stages which are switch controllable and provide the two separate clock frequencies required by the UARTs for up-down speed conversion.

The Signal Speed clock is Clock 1 and the Loop Speed clock is Clock 2.

With the MPC-1000R in Receive and the Memory section in Operate, Clock 1 drives the Input register and Clock 2 drives the Output register of Uart 1. When the TU is switched to SEND, the two clocks are reversed.

If the two clocks have been set to the same frequency, that is, the same speed, UART 1 functions solely as a regenerator.

When the two clocks are set for different speeds, the UART also functions as a speed converter, because it is outputting the data at a different speed than it took it in at.

When the MPC-1000R is in SEND-Recirculate (as when calling CQ from the preloaded memory), both the input and output registers of UART 1 are being driven by Clock 1, the Signal Speed clock.

When in RECEIVE-Preload, the output register is not permitted to output, because the memory is being deliberately loaded-up.

For this reason, a second UART has been implemented in the TSR-500D. Its input clock is <u>always</u> Clock 1 (Signal Speed) and the output clock is <u>always</u> Clock 2 (Loop Speed). Since the Loop Speed is identical to the local teleprinter's Baud rate, UART 2 provides local copy even when the TSR-500D is Recirculating or Preloading at Signal Speed.

A Memory Hold circuit (three elements of U25) has been incorporated which permits the local teleprinter to receive an incoming message via UART 2 when the Memory is recirculating.

This permits the operator to Preload the Memory with a CQ (or any other message), and to switch the TU to SEND-Recirculate, which will repetitiously transmit the contents of the Memory over and over again.

At the end of the transmission, the TU may be switched to Receive, leaving the Memory intact (still in Recirculate), and receiving an incoming answering signal, without loosing the Preloaded message.

If no answer is received, the TU may be switched back to SEND and it will immediately resume sending the originally Preloaded message.

If an answer is received, when the TU is switched back to Send, the Memory is simply cleared with the front panel CLEAR switch and the Memory switched to OPERATE.

Whenever the MPC-1000R is in RECEIVE, the Space-shift feature of the Word Correction circuit is inhibited by CR13 and the Input FIFO will always function as part of the main memory.

The Blank Erase circuit in Receive is also inhibited (when it is necessary to do so), because when the main memory section fills, it will enable the TD Inhibit circuit which in turn inhibits the Blank Erase circuit via CR15.

In other words, in Receive, with five FIFOs, a full 200 character buffer memory is provided.

The Dual One-Shot (U22) provides the automatic Variable Character Rate Control and functions only in SEND. It also provides the logic for the Phasing Pulse circuit, which only operates when the TU is in SEND and the Memory section is empty.

The BLANK and LTRS character generation is accomplished by pulling the tri-state output lines of FIFO 1 (OUTPUT FIFO-U4) either to ground or up to +5 volts thru the 4.7K resistors at R40 thru R47. These FIFO lines automatically go to tri-state when the Memory is empty.

As supplied by the factory, the BLANK character is enabled. LTRS character may be generated by removing the jumper AB and installing a jumper or 15 ohm resistor at AC.

The BLANK "diddle" is preferable, because it will not affect the FIGS or LTRS state of the receiving teleprinter.

A LTRS "diddle" may interfere with a slow typist's ability to send a FIGS character and then a numeral. If the LTRS character is automatically inserted by the diddler between the FIGS and the numeral, the receiving teleprinter will be back in LTRS case by the time the numeral character arrived, and the character Y

child 33511 or 33512 FIFO package.

To break-out the parallel data lines between the Input and Output registers of Uart 1 (for routing to some other peripheral device, such as a processor or additional memory), replace FIFO U5 or U6 with a 28 pin/cable assembly, or hard-wire directly to the jumper locations under the socket.

Code Conversion peripherals will not function properly with the TSR-500D, because the input and output registers of both UARTs are always set to the same coding level by NB-1 and NB-2 of the UART Program switch S3.

Although all logic elements in the TSR-500D are CMOS, they are fully-buffered to interface with TTL logic.

When interfacing to other CMOS circuits that are operating at higher levels, such as +12 or +15 volts, remember that Q1 is switching between zero to +5 volts.

The keyboard-controlled Word Correction circuit has been implemented at the Input FIFO (U8).

Whenever the MPC-1000R is in SEND, this Input FIFO stores the data from the local keyboard or Tee Dee. When it receives a SPACE character from the local teleprinter (which would normally be sent at the end of a word), the Input FIFO releases the word into the next FIFO (U7) and the word ripples down thru the memory to the first open location.

SPACE character recognition is accomplished in U12.

If an incorrect or mis-spelled word has been entered into the Input FIFO, it may be erased by sending a BLANK character from the local teleprinter.

BLANK character recognition is accomplished in U13.

The main memory section may contain one, two, three or four 40 character FIFO elements (U4 thru U7). Whenever the last FIFO in this section is filled, the Input FIFO (U8) is brought on-line as an over-flow FIFO, which adds 40 additional characters of storage to the main memory section.

Word Correction is automatically inhibited when the Input FIFO is in the Over-Flow mode and is accomplished by CR14 and CR15.

These diodes are tied back to the Set-Reset latch circuit in the Tee Dee Inhibit circuit, which in turn, is enabled when the last FIFO in the main memory section is filled.

For example, with 5 FIFOs installed, the Tee Dee Inhibit circuit is enabled when 160 characters have been stored, but the fifth FIFO comes on-line and lengthens the memory to 200 characters. This effectively prevents lost characters from overfilling the Memory, because at the same time the TD Inhibit circuit is enabled, the Variable Character Rate circuit is inhibited and the output character rate is raised to machine-speed.

The length of time that the character rate is maintained at machine speed is controlled by the time-constant of C17, R76 and R77. The factory installed values permit the memory to be emptied out at machine speed before the character rate is smoothly (not abruptly) lowered back to the preselected character rate.

The front panel Memory FULL LED lights when 160 characters have been stored and stays lit while the memory is outputting at machine speed.

The Word Correction circuit may be completely inhibited at all times by adding a jumper at location X2, which defeats the Space Character recognition circuit and removing the diode at CR2, which defeats the BLANK character recognition circuit.

With the Word Correction circuit disabled in this way, all the FIFO storage elements in the TSR-500D function as standard FIFOs in both SEND and RECEIVE.

An inversion scheme has also been provided on the control line (J1-8) that switches the TSR-500D between Receive and Send.

When installed in an MPC-1000R terminal unit, R62A and CR8 are installed and R62B and CR9 are omitted. This permits a zero signal (provided by pull-down resistor R61) to keep the TSR-500D in Receive until a +5 to +15 volts is applied by J1-8.

For other control applications, R62B and CR9 may be installed in place of R62A and CR8, in which case, the Control Line is pulled-high thru R63 and inverted by U24, putting the TSR-500D into Receive. A ground at J1-8 pulls the line low, which is inverted to a high state by the inverter U24, putting the TSR-500D into SEND.

Double inverters are used as LED drivers (DS1 and DS2) and assure full brilliance of both the front panel and board mounted LEDs.

Although the FIFO FULL line has been brought out from each FIFO in the J2 (rear) cable, they are not used when the TSR-500D is installed in an MPC-1000R.

Their primary purpose is to indicate the status of each FIFO (Full

or Empty) when the TSR-500D is used as a support element in a peripheral-type piece of equipment.

These lines are normally high (+5 volts) when the FIFO is empty and go to zero when the FIFO fills.

The five lines may be buffered (and inverted) thru a single hex inverter (such as the 14069) and used to drive individual LED indicators.

They may also be used to drive a digital to analog converter circuit, which in turn would easily drive an analog meter which would indicate the amount of storage, i.e., 20%, 40%, 60%, 80% and Full.

INTERNAL LOGIC - UART #1/MEMORY SECTION and UART #2 SECTION

The output register of UART 2 is always clocked at the speed set by the LOOP SPEED switch and provides local teleprinter copy when UART 1 and its memory section are being clocked at the speed set by the SIGNAL SPEED switch.

MEMORY	RECEIVE	SEND
OPERATE MODE	200 characters of FIFO memory. Word Correction circuits are disabled. Local teleprinter is driven by UART 1 and the Memory section. If down-converting, the Memory Full LED will light when 160 characters have been backed up in the memory section. Normally, the Memory EMPTY LED will be lit, since the OPERATE mode is usually set for straight-thru or up-conversion of the baud rate.	200 characters of FIFO memory. Word Correction is enabled and Input FIFO functions as a word-storage element that transfers a complete word to the main memory upon receipt of a Space character, or erases the complete word upon receipt of a Blank character. Memory Full LED lights on 160th character indicating only 41 characters of storage remaining (40 FIFO + 1 UART character), Input FIFO comes on-line as an over-flow storage element, Word Correction is inhibited, and Character Rate is automatically raised to machine speed until memory has been emptied. When Memory Full LED extinguishes, Word Correction is re-enabled and output speed returns to preset Character Rate. Local copy is provided by local keyboard.
PRELOAD MODE	200 characters of memory. Memory Full LED lights on 160th character, indicating only 41 characters of unused memory remain. Local printer is driven by UART 2 and prints what is being preloaded into the Memory Section by UART 1. Word Correction is disabled.	200 characters of memory. Word Correction is inhibited at 160th character and input FIFO comes on-line as over-flow FIFO when Memory Full Led is lit. Local copy is provided by the local keyboard.
RECIRCULATE MODE	Local printer is driven by UART 2 and provides local copy of recieved signals. This mode permits receiving an answer to a CQ without having to switch to Operate which would run out preloaded memory.	Local copy via UART 2 while UART 1 and Memory section are being recirculated at Signal Speed. Provides up-conversion when Signal Speed is less than LOOP Speed.

SECTION III - FRONT PANEL CONTROLS

AFSK SWITCH

The three positions of the AFSK Tone Keyer Switch (A, B & C) select the pre-set Mark and Space tones that have been calibrated into the tone keyer via the rear panel tone keyer calibration pots. Each pot is a 20 turn cermet potentiometer of infinite resolution and has a clutch action at the end of travel. Over-running the pot during calibration will not damage it.

To calibrate the Space tone, turn the REGEN ON-OFF switch to OFF, and remove the LOOP fuse, which breaks the loop line. This forces the AFSK tone keyer into Space. The Loop may also be opened by depressing the local teleprinter's Break button.

REGENERATOR/MEMORY SECTION SWITCHES

The SIGNAL and LOOP Signal Speed switches are calibrated in Baud. Each switch controls an independent BCD/N divider section that is driven by a common crystal-controlled oscillator.

The SIGNAL switch should be set to the baud rate of the RTTY circuit. The LOOP switch should be set to the baud rate of the local teleprinter. It is generally advantageous that the local teleprinter be operated at a baud rate equal to or faster than the fastest baud rate signal to be received.

The Memory section is controlled by two front panel toggle switches. These switches are labelled CLEAR-UNLOAD and OPERATE-PRELOAD-RECIRCULATE.

The CLEAR-UNLOAD switch is normally in its center-off position. When lifted to CLEAR, this switch immediately dumps the contents of the entire memory.

When lowered to the UNLOAD position, the preset Character Rate is increased to machine speed and the FULL LED indicator lights.

During this period (FULL LED lit), the Tee Dee INHIBIT circuit is enabled and permits an external relay to open the solenoid circuit of a tape-pulling TD, thus preventing character overruns during down-conversion of the baud rate.

This UNLOAD action is also automatically enabled whenever the last FIFO element in the main memory section is filled.

During normal operation, the OPERATE-PRELOAD-RECIRCULATE switch is left in the OPERATE position.

Moving the switch to PRELOAD permits the Memory Section to accept and store RTTY signals, either from the incoming signal (Receive) or from the loop (Send).

When Preloading in the Receive mode, a second UART (U2) provides regeneration and speed conversion from signal speed to loop speed and premits local copy.

In the RECIRCULATE position, the contents of the Memory are recirculated in UART #1 (U3) at Signal speed if in Send and at Loop speed if in Receive.

When recirculating the memory in Send, the second UART again provides local copy.

During normal (OPERATE) operation, the EMPTY LED will be lit, indicating that the incoming signal is flowing thru the Memory and not being stored.

If down-converting (i.e., copying a 50 Baud signal on 45.45 Baud teleprinter), this LED will extinguish as the Memory starts to store the over-runs, and will light again when the incoming signal "marks" long enough for the Memory to empty out.

In the Send mode, if the Character Rate has been set to something less than machine speed, a fast typist will be able to enter data into the Memory faster than it will be taken out.

If the Memory is filled, the FULL LED will light, indicating that the Input FIFO is absorbing the momentary overflow, that the slower Character Rate has been increased to machine speed and that the Tee Dee Inhibit Circuit has been enabled.

At the end of the machine speed emptying-out period, the FULL LED will extinguish and the Character Rate will drop smoothly (not abruptly) back to its preset, slower than machine speed Character Rate.

SECTION IV - PROGRAMMING THE REGENERATOR SECTION

Assuming that the MPC-1000R/TSR-500D is to be used for Radio RTTY communication (5 level Baudot), program the UARTs via the 8 pole DIP switch (S3):

SWITCH POLE	FUNCTION	MODE	SWITCH POSITION
8	NB1	Zero	LEFT
7	NB2	Zero	LEFT
6	TSB	1.5	RIGHT
5	SBR	NO	LEFT
4	PRTY	NO	LEFT
3	RPT	NO	RIGHT
2	PHSG	OFF	LEFT
1	PRLD	YES	RIGHT

UART CODING (NB-1 & NB-2) POLE 8 & 7

The Regenerator Section of the TSR-500D consists of a pair of Universal Asynchronous Receiver/Transmitters (UART), which may be programmed for 5, 6, 7 or 8 level codes via poles 7 and 8 of Switch S3.

These poles are identified as NB-1 and NB-2. The coding chart for NB-1 and NB-2 is etched on the PC board. For five level Baudot coding, NB-1 and NB-2 are both switched to ZERO (LEFT).

TOTAL STOP BITS (TSB) POLE 6

When programmed for a five level code, some UARTS permit the total number of Stop Bits to be set to 1.5, instead of the more common 1.0 or 2.0 character units.

This permits a character unit coding of 7.5, instead of 7.0 or 8.0.

The TSR-500D has been designed with an Automatic Stop Bit Length Select circuit.

When Pole 6 is programmed to the RIGHT for a 1.5 CU Stop Bit, the UARTs are programmed for a 1.5 CU Stop Bit when the TSR-500D is in SEND and for a 1.0 CU Stop Bit when the TSR-500D is in RECEIVE.

Selecting Pole 6 to the LEFT provides a 1.0 CU Stop Bit in both Send and Receive.

To permit a 1.5 CU Stop Bit in both Send and Receive, remove the diode directly below the U3 UART and change the 100K resistor at R39 to a 10K, 5% resistor.

RECEIVED STOP BIT REQUIRED (SBR) POLE 5

Switch pole 5 sets the SBR (Stop Bit Required). Normally, it is best to leave this function in the NO position. There is no reason to force the UART to dump a good character just because the Stop Bit was not detected.

With the high redundancy of the English and Spanish languages, it is always better to print a character, even if it is wrong, because the automatic Stop Bit generated by the UART will prevent the local teleprinter from losing signal synchronization.

PARITY SELECT (PRTY) POLE 4

Switch pole 4 permits selection of PARITY, a function not normally used in Radio TTY communication. This switch should be left in the NO position.

If Parity is required, consult the manufacturer's spec sheet on the particular UART installed in the TSR-500D.

Most Uarts select Parity in the following way:

NP	ESP	MODE
Ø	Ø	ODD
Ø	1	EVEN
1	Ø or 1	NO

PRELOAD AND RECIRCULATE (PRLD & RPT) POLE 3 & 1

Switch poles 1 and 3 provide Preloading and Recirculation of the Memory section. Since these positions are over-ridden by the front panel toggle switches, both of these switches MUST be in the RIGHT position: REPEAT-NO and PRELOAD-YES.

PHASING (BLANK-LTRS) PULSES (PHSG) POLE 2

Programming the PHASING function ON will provide an automatic generation of the BLANK character when the MPC-1000R is in SEND and the Memory section is empty. This BLANK character may be changed to a LTRS character by removing the jumper in the BLANK location and inserting a 15 ohm resistor in the LTRS location just to the right of it.

The BLANK character has an advantage over the LTRS character, since the case state (FIGS or LTRS) of the receiving teleprinter will not be changed by receipt of the BLANKS character.

The LTRS character option has been provided for commercial users that require Phasing Pulses (single Start pulses) during periods of inactivity to maintain synchronization of their crypto equipment.

The PHASING option (BLANKS or LTRS) may be inhibited entirely by switching Pole 8 of the UART program switch to OFF (LEFT) position or by grounding the rear panel PHASING connector. It is automatically inhibited when the MPC-1000R is in the REC mode or when the TID-100 is enabled.

The repetition rate of the BLANK (or LTRS) character is determined by the setting of the CHARACTER RATE adjustment pots. One pot is board-mounted on the TSR-500D assembly and the other is on the rear panel of the MPC-1000R.

VARIABLE CHARACTER RATE (R74)

Character Rate is normally set for some rate less than machine speed.

Its sole purpose is to lengthen the Stop Bit duration of each regenerated character as it is transmitted, smoothing out the signal at the receiving teleprinter. This slower character rate does not change the basic baud rate of the outputted signal.

As an example, a 45.45 Baud signal that normally has a speed of 60 WPM (at machine speed), may have its Character Rate slowed to 40 or 45 WPM by merely lengthening the stop pulse on the end of each character.

A dual one-shot circuit at U22 provides this "long stop" pulse.

With a slower character rate, the main memory section may be filled more easily, and should this happen, the Character rate is automatically increased to full machine speed.

At the same time, the Input FIFO element that normally provides Word Correction comes on-line as an overflow FIFO and its entire 40 character storage may be used in the normal mode.

When this condition occurs, the front panel FULL LED will light, indicating to the operator that he has filled the main memory and is outputting the stored data at machine speed.

It also indicates that if he is inputting at a faster rate than the output rate and that the Input FIFO has come on-line as an overflow buffer.

Whenever the FULL LED is lit, the TEE DEE Inhibit circuit is also enabled and may be used to inhibit a tape pulling Tee Dee or to provide an aural or visual alarm.

NOTE: If any difficulty is experienced with dropping an occasional character while recirculating at machine speed, increase the value of R73 (20K) to 27K. This will slow down the spoon-feeding rate of the Dual One-Shot U22 when operating at machine speed.

This is also an effective way of stretching the time duration of the Stop Bit and may be used to generate long Stop Bits should the requirement arise. The higher the value of R73, the longer the Stop Bit will be. A 27K resistor at R73 will provide a Stop Bit length of approximately 2.0 when putputting at machine speed.

SECTION V - DUAL CLOCK

The dual-clock is crystal-controlled at 60.000 KHz. Two identical divider sections divide this frequency down to those frequencies required by the UART's input and output clock ports for operation at the various Baud rates.

The front panel speed select switches are calibrated in terms of Baud:

SWITCH CAL	ACTUAL BAUD	SPEED - WPM
45	45.45	60 (61.3)
50	50.00	66.6
57	56.88	75
75	74.2/75.0	100/106
110	110.00	100/ASCII

When the MPC-1000R is in REC, Clock 1 provides the SIGNAL speed clock frequency to the input clock port of the UART regenerator (U3). Clock 2 provides the LOOP speed clock frequency to the output clock port.

When the MPC-1000R is switched from REC to SEND (locally or remotely), Clock 1 and Clock 2 are interchanged at the UART by the bilateral steering section. The input and output data lines are also interchanged at the Uart's data ports simultaneously.

This switching action permits an incoming signal to be up-converted to a faster teleprinter during REC, and the teleprinter's faster keyboard signal to be down-converted to the slower signal rate during SEND.

SECTION VI - TEST POINTS (TSR-500D)

Test points have been provided on the TSR-500D assembly to aid in trouble shooting.

TP-1: CRYSTAL OSCILLATOR OUTPUT

The oscillator circuit is comprised of a Statek "tuning-fork" type quartz crystal and a CMOS 4007 dual complementary pair plus inverter. This type of oscillator requires very low current and often requires two or three seconds to start oscillating after turn-on. The nominal frequency of the crystal is 60.000 KHz ±0.05%.

TP-2: CLOCK 1 OUTPUT

The frequency at TP-2 is the output of the BCD/N dividers U18 and U19 as programmed by the SIGNAL Speed Select switch located at S1.

TP-3: CLOCK 2 OUTPUT

The frequency at TP-3 is the output of the BCD/N dividers U20 and U21 as programmed by the LOOP Speed Select switch located at S2.

Clock 1 and Clock 2 should output the following frequencies, depending on the setting of their respective speed switches:

45 Baud (60 WPM)	732 Hz.
50 Baud (66 WPM)	800 Hz.
57 Baud (75 WPM)	909 Hz.
75 Baud (100 WPM)	1200 Hz.
110 Baud (100 WPM ASCII)	1765 Hz.

TP-7: UART INPUT CLOCK

The frequency at TP-7 is the Input Clock to UART #1 (U3) at the output of the bilateral steering section. In REC, it is Clock 1 and in SEND it is Clock 2.

TP-4: UART OUTPUT CLOCK

The frequency at TP-4 is the output Clock to the UART (U3) at the output of the bilateral steering section. In REC, it is Clock 2 and in SEND it is Clock 1.

In PRELOAD, TP-7 and TP-4 will both have Clock 1 signals when the MPC-1000R is in REC. When in SEND, both test points will have Clock 2 signals.

In RECIRCULATE, both test points will have Clock 2 in REC and CLOCK 1 when in SEND.

Since Uart #1 is being clocked by Clock 1 when the MPC-1000R is in SEND/RECIRCULATE, and the local teleprinter is normally geared to match Clock 2, a second Uart (U2) has been provided whose input clock is always Clock 1 and output is always Clock 2.

During SEND/RECIRCULATE (and RECEIVE/PRELOAD), the local teleprinter will copy the outgoing-recirculated signal at Loop Speed (S2) although the signal is being outputted at whatever Signal Speed has been selected by S1.

TP-5: UART DATA INPUT LINE

This test point is the same as pin 20 on the Uart #1, which is the DATA INPUT port. In REC, it will contain the unregenerated incoming signal, and in SEND, it will contain the unregenerated signal as originated at the local teleprinter, Tee Dee, etc.

TP-6: UART DATA OUTPUT LINE

This test point is the same as pin 25 of the Uart #1, which is the DATA OUTPUT port. In REC, it will contain the regenerated incoming signal, and in SEND, it will contain the regenerated outgoing signal from the local teleprinter, Tee Dee, etc.

TP-8: SPACE CAL

A ground to this point will force the AFSK tone keyer into the Space condition, if the rear panel REGEN ON/OFF switch is in the ON position.

TP-9: TONE ENABLE

This TP goes high on SEND, i.e., +5 volts, and may be jumpered to the TMS-100 Tri-Mode Tone Selector assembly at the rear panel to provide an automatic turn-on of the internal Tone Keyer when the MPC-1000R is put in SEND. To accomplish this action, the jumper wire on the TMS-100 must be removed.

SECTION VII - UART NUMBER TWO

UART No. 2 (U2) provides local copy when the MPC-1000R (and TSR-500D are in the Receive-Preload and Send Recirculate modes.

The Input Clock of UART No. 2 is ALWAYS Clock 1, i.e., Signal Speed.

The Output Clock of UART No. 2 is ALWAYS Clock 2, i.e., Loop Speed.

It is automatically utilized whenever the signal being processed by Uart No. 1 (U3) and the FIFO Memory Section is operating at Signal Speed, which normally would not be copiable on the local teleprinter, which is operating at Loop Speed.

Its function is to up-convert Signal Speed signals to the baud rate of the local teleprinter.

It also provides local teleprinter copy on incoming signals when the terminal unit is in Receive and the Memory Section is in Re-circulate.

This permits a previously stored CQ to be held in the Memory, while the operator switches the TU to Receive and listens for a QSL.

If a QSL is not received, switching the terminal unit back to SEND permits the previously preloaded CQ to be transmitted again without the need for preloading the Memory a second time.

SECTION VIII - WORD CORRECTION

Unless specifically inhibited by installing Jumper X6 on the TSR-500D board, the TSR-500D provides keyboard-controlled Word

The Word Correction circuitry functions only when the terminal unit is in SEND.

Whenever a word is generated by the local keyboard, the entire word is entered and stored in the input FIFO (U8). It is transferred as a complete word when a SPACE character is generated by the local keyboard.

If the word entered is correct, it will be automatically transferred when the keyboard operator "spaces" and goes on to the next word.

If the word is incorrect or mis-spelled, it may be erased from the Input FIFO by the operator merely sending a BLANK character from the local keyboard.

If SBR (Stop Bit Required) has been set to NO, opening the loop via the BREAK button will also erase the unwanted word.

The Space-Shift function is accomplished by SPACE character recognition in U12.

The Blank-Erase function is accomplished by BLANK character recognition in U13.

With SBR set at NO, opening the loop (by pressing the keyboard BREAK button) fakes the input register of the UART into accepting a BLANK character. This Blank character will be shifted into the Input FIFO and perform the Word Erase function. The UART will not accept a second BLANK character in this manner until the loop has been restored to Marking and broken again a second time.

With SBR set at YES, the UART will reject the open condition when it checks for a valid Stop Bit and finds the loop still in a Space condition.

Although using the BREAK button to generate a BLANK character for Word Erase will work, breaking the loop will let the teleprinter's typing unit run open if it is connected in series with the keyboard, and the result may be printed garble.

A rear panel WORD Erase connector has been provided for the operator who does not want keyboard erase with a BLANK character, or in the event that the local teleprinter does not have a BLANK character key.

To inhibit keyboard control of Word Erase, remove CR2 (1N4148) from the TSR-500D board.

A contact closure to ground at the rear panel Word Erase connector (J20) will provide a Clear signal to the Input FIFO (U8). The front panel CLEAR switch will clear all of the FIFOs.

The Word Correction circuitry is automatically inhibited by CR14 and CR15 whenever the main Memory section fills completely, permitting the Input FIFO to come on-line as a standard 40 character storage element.

SECTION IX - AUTOMATIC WORD STORAGE OVER-RIDE

Whenever the TSR-500D is in SEND, the input FIFO is used as a Word Storage FIFO and is controlled by the receipt of a Space or Blank character generated by the local keyboard or Tee Dee. This is Word Correction.

When pulling tapes without Space characters, the input FIFO would normally load up with forty characters and then be over-run. To prevent this from happening, an Automatic Word Storage Over-Ride circuit (consisting of C25, R85, C18 and C19) has been provided.

Whenever the input FIFO "flags" that it has accepted 39 characters and is about to be over-run, it automatically transfers its contents to the main Memory Section, thus making room in its 40 character memory for additional data.

SECTION X - AUTOMATIC MEMORY CLEAR

Without Automatic Memory Clear, the Memory Section of the TSR-500D would self-load with 200 random characters every time the terminal unit is initially turned on.

If not cleared manually by the front panel CLEAR switch, these 200 characters of garble would output at machine speed to the local teleprinter.

A 10 MFD capacitor at C20 holds down the Memory Reset line for a few hundred milliseconds at turn on, thus providing a cleared memory at turn-on.

SECTION XI - TEE DEE INHIBIT CIRCUIT

The TD INHIBIT circuit is an open collector transistor switch, 2N697 (Q4).

This circuit is not current-limited within the terminal unit, but the collector curcuit does contain a polarizing diode.

Current limiting of this circuit is normally accomplished by the impedance of the external relay, used to control the TD solenoid. This relay is not furnished by Dovetron, and any fast 12 or 24 VDC relay is adequate. The external relay should have a despiking diode across its solenoid. If 110 VDC switching is required, the 2N697 may be replaced with a 2N3439 or similar high voltage transistor.

SECTION XII - PARALLEL DATA OUTPUT OPTION

All eight parallel data lines of the Memory section are available for expansion to peripheral equipment via a 16 hole pattern located under FIFOs U5, U6 and U7.

When FIFOs are not installed in these locations, jumpers or low-resistance resistors are factory-installed for circuit continuity.

SECTION XIII - VARIABLE FEATURES

Many variable features have been provided on the TSR-500D assembly.

SPACE CAL may be had on J2-7 by installing Jumper X1 and removing Jumper X2 (which provides Word Erase at the rear panel).

DATA INPUT is normally considered to be Mark High and Space Low. The Data Input line may be inverted at Jumper X3. Cut out the etch and install jumper, bringing inverter U24 into the circuit.

The input FSK line is factory configured for EIA RS-232C polarity, Mark Low and Space High. This polarity may be reversed to accept MIL 118C by removing Jumper BC and installing Jumper AC at the output of the Inverter U16.

DATA OUTPUT is normally configured as Mark High and Space Low. Its polarity may be reversed at Jumper X4, which brings inverter U23 into the output circuit.

The AFSK KEYER is normally configured for EIA-232C polarity of

Mark Low and Space High. Changing the jumper at X5 changes polarity to the MIL 188C configuration of Mark High and Space Low. Adding R60 (1K) reduces output at J2-9 from ±12 volts to ±6 volts.

SECTION XIV - CHARACTER RATE CONTROLS

Two Character Rate controls have been provided on the MPC-1000R.

One is located on the TSR-500D assembly (R74) and should be set full CCW.

The rear panel Character Rate control (located directly above the AUDIO INPUT connector) will now set the preferred Character Rate. Full CCW (as viewed from the rear of the TU) produces normal machine speed.

To assure smooth UART operation when recirculating, if slower than machine speed operation is not desired, set the Character Rate just slightly below normal machine speed.

SECTION XV - REGEN ON/OFF SWITCH

With the rear panel REGEN ON/OFF switch in the OFF position, the MPC-1000R functions as a standard MPC-1000C and the PHASING and WORD ERASE connectors, and the Character Rate control are inoperable, as are the front panel Speed Switches, the Memory Section Switches and the EMPTY and FULL LED indicators.

With the REGEN ON/OFF switch in the ON position, all incoming and outgoing data (except MS reversals) are processed thru the TSR-500D regeneration circuits.

SECTION XVI - MS REVERSALS (RY GENERATOR)

When the MODE switch is in the MS-REV position (in both SEND and REC functions), the AFSK tone keyer outputs mark-space reversals, whose baud rate is dependent on the setting of R163 on the main board.

When in DIV OFF, MO, MS (Normal operation) or SO, and in REC function, the EIA and MIL FSK outputs are regenerated, since they are driven by the regenerated high level loop keyer on the main

board. A 3rd FSK signal (Zero volts, Mark & +5 volts, Space) is available at FSK (J8) at the rear panel.

When in SEND, EIA and MIL FSK outputs are not regenerated, but the FSK output at J8 is regenerated. If the Memory section is empty and no data is being entered, this FSK will output the PHASING pulse (selectable BLANKS or LTRS characger), if the Phasing switch at S3 (pole 8) is ON, and if the rear panel PHASING port has not been grounded.

SECTION XVII - REMOTE CONTROL

The front panel REC-SEND switch may be left in the REC position, and the MPC-1000R may be remotely switched to SEND by applying +5 to +15 volts to the rear panel LOCK connector.

A regulated source of +15 volts has been provided at the rear panel for this purpose and is current-limited to 3 mils.

Do not attempt to use this voltage source for external relays, etc.

If the +15 volt is shorted, or over-loaded, no damage will occur within the terminal unit. The accidental application of high voltages to this port from an external source will not damage the the terminal unit either.

The impedance protection of this +15 volt source is accomplished by a 4.7K resistor mounted on a terminal strip next to the 600 ohm audio input transformer.

A Remote Interface (RIF-100) option is available to permit manual selection of either the standard remote control configuration or a "ground for Send" configuration.

SECTION XVIII - DAS-100 DIGITAL AUTOSTART MODULE

The DAS-100 Digital Autostart Module replaces the CMOS 14011 originally installed in location U11 on the TSR-500D board. It monitors the output of the parallel receiver register of UART U3. When it recognizes a SPACE character, it sends a start command to the autostart circuits on the main board via a wire connected to its output port (AUTO).

This digital autostart mode of operation also functions when the

rear panel REGEN ON-OFF switch is in the OFF (down) position.

Although the digital autostart is always connected to the autostart circuits, its commands are over-ridden by MARK and FSK autostart commands when the front panel switch is in the MARK or FSK position.

With the Character Recognition pot (R1) set to mid-range, at machine speed three space characters must be recognized to initiate autostart. At slower keyboard speeds, a single space character can initiate autostart, since the single output register of the UART will contain the Space character information for a longer time period.

For proper operation, the terminal unit Signal Speed Select switch must be set to the speed of the incoming signal and the terminal unit's "sense" switch must be set for the right polarity, i.e., Normal or Reverse.

If up side down, the DAS-100 may turn on with a FIGS character, but normally not enough FIGS characters are sent in straight text to allow the DAS-100 threshold circuits to charge up.

The ØØ line from the DAS-100 module permits the word storage FIFO of the TSR-500D to hold the incoming data in memory until the DAS-100 has started the local teleprinter and the printer's motor has had sufficient time to come up to full speed.

Setting R1 to extreme clockwise requires a string of 10 or more Space characters sent at machine speed to initiate turn on, thus providing a limited form of selective calling.

If the TSR-500D is equipped with the SCL-100 Selective Calling module, the DAS-100 monitors the incoming signal and in the event that a Turn-Off code is not received by SCL-100, will start a time out event after loss of a copiable RTTY signal. It will also initiate time out if the incoming signal inverts or changes baud rate.

Normal installation (without SCL-100 option) is: AUTO connected to E-16 on main board (feed thru directly in front of capacitor C57) and ØØ connected to corresponding ØØ on main board (directly in front of K1 autostart relay). The module itself is plugged into socket U11 on TSR-500D board.

SECTION XIX - TMS-100 TRI-MODE SELECTOR

The front panel AFSK tone combination Select Switch controls the

state of two bilateral CMOS switches (14066) mounted on the TMS-100 board at the rear panel. This card contains six multi-turn Cermet potentiometers, two of which are selected by each position of the front panel AFSK Tone Select switch.

The three different combinations of Mark-Space-Shift tones are completely independent of each other, and provide the operator with a convenient method of quickly changing AFSK shifts.

In position C, R15 and R16 locations have been provided to permit installation of resistors to permit generation of lower than normal Mark and Space tones for wire line modem use. To utilize R15 and R16, open the circuit etch on the top of the TMS-100 board and install appropriate resistors. Metal film resistors are recommended for good long term stability.

SECTION XX - AFSK TONE INHIBIT OPTION

As supplied by Dovetron, the MPC-1000R outputs the AFSK tones from the internal AFSK Tone Keyer in both the Receive and Send modes, which in turn, permits RY generation in both modes.

Provisions have been made to permit the generation of these AFSK tones only when the TU is in SEND.

This permits:

1) The front panel SEND switch to be effectively used to turn a SSB transmitter ON via its internal VOX circuitry. When the TU is put in SEND, the AFSK tones are turned on, which are sensed by the transmitter's VOX circuit, which in turn, immediately turns on the transmitter or transceiver.

2) Some transceivers pass audio from the audio (microphone) input stages thru to the audio output stages even during Receive. This is a function of their particular VOX circuitry. The AFSK tone Inhibit feature will silence the AFSK tones during these periods of Receive and prevent the AFSK tones from leaking thru to the audio output.

To inhibit the AFSK tones during Receive, remove the jumper installed between the TONE CONTROL E-Point and the +15 VDC E-Point on the left side of the TMS-100 card. Connect a wire between the TONE CONTROL (or the open E-Point next to it) and the anode of CR54 on the TU's main board.

TP9 on the TSR-500D board may also be jumpered to the Tone Control E-Point to provide +5 volts on Send.

With the AFSK tones inhibited during Receive, the RY Generator will no longer supply Mark-Space Reversals to the local teleprinter when the MPC-1000R is in Receive.

SECTION XXI - KOS-100 KEYBOARD-OPERATED-SEND OPTION

The KOS-100 is hardwired into the MPC main frame and interfaces to the TID-100 Station Identifier thru a 16 pin header and socket interconnect.

The KOS-100 permits the terminal unit and companion transmitter to be put into the SEND mode by merely depressing one of the keys of the local teleprinter.

Opening the loop momentarily (BREAK button, etc.) puts the terminal unit into Preload while the TID-100 is identifying.

A variable time out control permits 1 to 10 second time out (return to receive mode) after the Memory Section has emptied.

SECTION XXII - RIF-100 REMOTE INTERFACE OPTION

The RIF-100 may be used to invert the remote LOCK line from +V to Lock to a Ground to Lock configuration. It also provides a convenient method of KOS control when used with teleprinters or electronic keyboards that provide a ground closure each time a key is depressed.

SECTION XXIII - SCL-100 SELECTIVE CALLING WITH TURN-OFF OPTION

The SCL-100 may be plugged into a TSR-500D Regenerator assembly and provides Sel-Cal Turn On with receipt of a 4 character code. The Turn Code is programmed into the SCL-100 via multiple DIP slide switches. The TURN-OFF code is a four character sequence and this character (single character) is also switch selectable. The SCL-100 is interconnected to the DAS-100 Digital Autostart module in such a way to provide automatic turn off in the event of signal loss or baud rate change.

SECTION XXIV - BALANCED TONE KEYER OUTPUT

The standard AFSK tone keyer output is 500 ohms, unbalanced.

A balanced AFSK tone keyer output is available as an option and is field-installable.

The recommended audio transformer is a Triad TY34X or equivalent.

Installation should be made per Dovetron print 75120A or 75143.

Note: In order to provide a balanced (in addition to isolated) configuration, the secondary's center-tap is grounded. This is the RED wire. It is mandatory that this center-tap be lifted from ground, if this output is to be used to drive a single-ended (grounded) audio input stage of a transmitter.

If the ground is not lifted, operating into an unbalanced line will put a short across half of the transformer's secondary winding.

Unless specified differently, the balanced output characteristics are:

600 ohm, balanced, Ø dbm.

When making a field installation, two convenient ground locations for the Red and Green wires will be found next to E55, which is also Ground.

SECTION XXV - SSD-100 SOLID STATE DISPLAY OPTION

The SSD-100 is a solid state replacement for the 2 inch CRT display. Since it operates from low voltage (+5 and +15 volts), it also obviates the requirement for the CRT's high voltage power supplied and associated circuitry.

It consists of a dual-bargraph configured as an RTTY tuning cross and utilizes rectangular high brilliance red LEDs mounted behind an optical filter. A high-low intensity circuit is controlled by the front panel mounted photocell. An internal photocell mounted behind the optical filter may also be used.

A single LED in the upper left quadrant of the cross display indicates the presence of time dispersive multipath distortion.

Two LEDs at the apex of the cross display indicate acquisition of

signal (AOS) and proper tone selection.

The SSD-100 may be retrofitted into all MPC terminal units originally equipped with CRT displays.

SECTION XXVI - TID-100 TELEPRINTER IDENTIFIER OPTION

If installed in the MPC-1000R, the TID-100 is mounted between the main board and the TSR-500D Regenerator assembly.

Output 1 is connected to E56 on the TU's main board. The START line is connected to J9 at the rear panel (CW ID). A momentary ground at J9 initiates the TID-100, which keys the CW ID circuit in the TU at approximately 10 WPM. This configuration provides narrow shift CW ID.

Output 2 is used to key the Memory Empty LED and give a front panel indication that the TID-100 is functioning during its operate cycle.

SECTION XXVII - EXTERNAL PERIPHERALS

Rear panel connectors have been provided for interfacing data peripherals, such as microprocessors, crypto equipment, code converters, selective calling units, etc.

These connectors are labelled REGEN IN and REGEN OUT, and have a jumper installed in them inside the TU.

The FSK drive line to the AFSK tone keyer and the AFSK Keyer lines are also available at the rear panel and have an internal jumper between them.

These jumpers may be removed (with the REGEN ON/OFF switch in either position) for peripheral interfacing.

All four of these lines are impedance buffered to protect the internal circuits from over-stresses from outside.

SECTION XXVIII - ADDENDA (MAIN BOARD CHANGES)

The main PC board in the MPC-1000R is identical to the main board that is used in the E Series MPC-1000C and the main board print

(75103-E) applies with a very few minor variations. The variations are called out on the MPC-1000R REGENERATIVE FUNCTION DIAGRAM (MPC-1000C/TSR-500D/TMS-100/TID-100). Information on this print supercedes any conflicting information in the MPC-1000C manuals or prints.

The following applies to all MPC-1000R terminal units:

1) R5 has been changed from 10K to 270K. The PC board input gain pot that controls the feedback of Z2 is factory set to mid-range.

2) R143 and R146 have been changed from 2.0K to 2.49K, and expand the tone range of the AFSK tone keyer.

3) R206 and R207 were single-turn tone adjustment pots on the rear panel. They have been replaced by the TMS-100 Tri-mode Selector assembly.

4) The Mark and Space VFO timing capacitors are 0.056 Mfd polycarbonates, similar to those used in the MPC-1000C.

5) R179A has been changed from 1.5 Megohm to 1.0 Megohm and permits the CRT dot to deflect all the way off of the CRT's screen. CR53 is not installed. See page 18 of MPC-1000C Section.

6) CR38 has been replaced with a 2K, 5%, 1/4 watt carbon-film resistor and provides harder keying for the high level loop keyer.

7) Dual Diversity connectors are provided on the rear panel of the MPC-1000R. These connectors may be used for an external CRT display by moving the wires in E53 and E54 to E51 and E52.

DOVETRON TID-100 TELEPRINTER IDENTIFIER

OPERATING INSTRUCTIONS

The TID-100 Teleprinter Identifier may be programmed for Morse, Baudot or ASCII code generation.

Programming instructions for Morse Code generation are etched right on the TID-100 PC board.

Instructions for programming the TID-100 in either Baudot or ASCII codes are contained on the TID-100 print 75128A.

The speed at which the characters are generated are controlled by a potentiometer (R1) mounted right on the PC board. For Morse Code, this potentiometer is normally set full CCW and provides a CW speed of approximately 10 WPM.

If used for Baudot or ASCII code generation, R1 must be adjusted for the desired baud rate.

Z1 is a quad two-input Nand gate. The first two sections are used as a clock and the last two sections are used as a set-reset latch.

This IC (Z1) should be unbuffered CD4011 or MC14011. Buffered units will have the suffix B (example: MC14011BCP) and should not be used. The RCA CD4011AE is an excellent choice.

Output 1 is configured as an open-collector transistor switch and may be used to key the CW ID line of an RTTY Terminal Unit. It will not key a dry circuit and is not current limited.

Output 2 is also an open-collector transistor and may be used to key an external (or front panel) indicator. It is used this way in the Dovetron MPC Series terminal units.

The Phasing Inhibit (PI) lines are provided to shut off the Phasing Pulse (Blank Diddle) of the TSR-500D during the identifying period.

To initiate a code sequence, a momentary ground is applied to the START line, which sets the Latch circuit and enables the Clock circuit.

The Clock circuit runs until the Latch circuit is reset by a pulse from Z2/Z3 (pins 13 or both) via C3. While the Clock is running, the Clock LED (DS1) will flash with each Clock pulse.

The coded output from the Matrix drives the Code Keyers (Q1 and A2) via DS2.

It is normal for DS2 to extinguish before DS1, since the 128 character matrix is not usually fully programmed.

Power requirements are +5 to +18 volts, 1 Ma. standby, 7 Ma. operating.

INSTRUCTION MANUAL

DOVETRON MPC-1000C

MULTIPATH-DIVERSITY RTTY TERMINAL UNIT

E - SERIES

DOVETRON ⊥ 627 Fremont Avenue
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MPC-1000C.300 and up.

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THIS MANUAL IS COMPLETE WHEN SCHEMATIC DIAGRAM 75103E AND COMPONENT LOCATION PRINT 75100E ARE ATTACHED.

PREFACE

Many schemes have been presented to improve the performance of RTTY Terminal Units in the presence of the anomalies of HF (3 to 30 MHz) radio propagation.

Most of them, with esoteric sounding names, like Automatic Threshold Corrector, Decision Threshold Computer, Axis Restorers, Hard Limiters and the like, addressed themselves to the problems of fading and noise.

It was reasoned that an FM discriminator with hard limiting would overcome the problems of AM noise pulses and fading. To a large extent, these designs were successful.

But too often, signals could still be heard, or seen in the various display units, and no copy could be had on the teleprinter.

Ingenious circuits were devised that doubled (or quadrupled) the redundancy of the Baudot Code, and large capital investments were made in dual receiving installations that permitted Dual-Diversity operation, where two antennas, two receivers, and two terminal units with a combiner were used to drive a single teleprinter.

This approach certainly works better, as evidenced by the many Dual (polarization, frequency and space) Diversity systems in use today.

But little work was done in the area of In-Band Diversity, where the Mark and Space signals being transmitted by a single transmitter are received and treated as two independent AM stations operating a few hundred Hertz apart, both containing precisely the same information at the same time.

Systems that attempted such an AM Diversity approach, often called TTL, Two Tone Limiterless, usually ended up with a hard limiter to prevent hits from fast fades of the long marking pulses between the characters of keyboard signals.

Realizing that almost all terminal unit designs were adequate when operating with good signals, Dovetron initiated a program in 1971 to develop a terminal unit that would offer the best of both worlds: FM and its hard limiting, and Linear AM with its benefits of In-Band Diversity.

With the development of the AMTI-MARK/FADE circuit, it was possible to have all the advantages of AM Limiterless operation, taking full benefit of the independent action of the Mark and Space tone channels, and at the same time, not taking hits at slow keyboard speeds.

But it became obvious very early that another phenomena was present: Time and Frequency Dispersion of both the Mark and Space channels, i.e., Multipath Distortion.

Unlike Selective Fading, which is also a form of Multipath Distortion, the phenomena stretched and smeared the pulses in time and modulated each in frequency.

Dual trace oscilloscope analysis (using the computer designed Bessell Function filters in the Dovetron prototype) revealed that the information was there, but not in a form that a conventional FM terminal unit could copy.

Often considered a night-time phenomena on the lower frequencies, Multipath Distortion was also discovered to be present during the daylight hours on almost all signal paths in the HF spectrum. Conjecture led to the belief that this phenomena was probably caused by simultaneous auroral and/or equatorial side paths. The design goal was not to discover why it existed, but rather how to cope with it and demodulate the information available with the lowest possible error rate.

So in addition to designing a terminal unit that took advantage of selective fading as caused by Multipath Propagation, a design effort was made to cope with the smear and overlap of the alternating Mark and Space pulses.

The problem became more complex when it was determined that the strongest channel was not necessarily the wanted channel. The term MULTIPATH CORRECTOR™ was coined and Dovetron set out to develop one.

Many versions of Multipath Correction were developed. Some of them worked quite well. Some were very simple and others were very complicated. Some were asynchronous and had to be clocked at the incoming Baud rate, and others ran in an independent synchronous mode.

It was finally determined that a simpler asynchronous approach was feasible, was easy to manufacture, required no maintenance or adjustment, and produced the desired results.

Rather than quote error rate differentials, it is just simpler to say that if it can't be copied on the Dovetron MPC Series, it probably can't be copied.

To permit the MULTIPATH CORRECTOR™ to function properly, it was necessary to demodulate the Mark and Space channels without adding any significant pertubations. This was done with two identical VLF receivers, one tuned to the Mark frequency and the other tuned to the Space frequency. Their identicalness assured that any distortions or timing errors added to one channel would be added to the other in a like amount.

It worked. Multipath Correction became a reality without sacrificing the high performance of the Linear AM circuits.

The two identical receivers were incorporated into a single package with a common power supply. A CRT Cross Display was added for ease of tuning. Peripheral non-data circuits were added, and the Dovetron MPC-1000C became a finished product.

Needless to say, acceptance was immediate.

As feedback was collected from users in the field, additional features were incorporated into the design.

The culmination of this effort was realized with the sixth generation. Its designation is: E Series.

We sincerely hope you enjoy the performance of the E Series MPC-1000C as much as we enjoyed developing it.

DOVETRON

SECTION I

OPERATING HINTS

For the operator who prefers to turn on a new piece of equipment and read the manual later, the following is offered:

1) Attach power cord, teleprinter's loop line and audio line from receiver.

2) Set LOOP adjustment potentiometer on rear panel to full counter clockwise position (MIN).

3) Place all front panel toggle switches UP.

4) Set the LEVEL control at 9 o'clock.

5) Set the THRESHOLD control at 12 o'clock.

6) Set Mode switch to MS, which is the normal Mark-Space In-Band Diversity position.

7) Adjust Mark VFO to 2125 Hz.

8) Adjust Space VFO to desired space tone frequency:

   2295 Hz. for 170 Hz. shift.

   2975 Hz. for 850 Hz. shift.

   2550 Hz. is the proper space tone for 425 Hz. commercial shift.

9) Tune in a RTTY signal and start copying.

10) If garbled, reverse NORMAL/REVERSE switch.

11) Now sit back and read the rest of this manual and discover all the other things that the MPC-1000(C) can do.

If after reading the manual and studying the prints, should problems or questions persist, contact DOVETRON at 627 Fremont Avenue, South Pasadena, California, 91030, or call: 213-682-3705.

SECTION II

INSTALLATION INSTRUCTIONS

1. Observe the power-main requirements as marked on the rear panel just below the AC power cord receptacle.

   The MPC-1000C may be internally strapped for 110 VAC or 220 VAC operation from single phase, 50 to 400 Hz power mains.

   To change the AC input voltage range, remove the top and bottom covers and locate the voltage selection jumpers next to the wire leads of the power transformer. Two jumpers are required for 110 volt operation. Only one lead is required in the middle jumper holes for 220 volt operation.

2. A three-conductor power cord is supplied with the MPC-1000C. The third conductor in this cord should be connected to a good earth ground, both for safety and for high performance of the terminal unit.

3. The neutral high level (120 volt DC, 60 Ma.) output has its own internal loop supply. Do not attempt to use a teleprinter that has a wired-in internal loop supply. The loop supply is adjustable over the range of 40 to 70 milliamperes, and is fused at the rear panel with a 0.1 ampere fast blow fuse.

4. Connect the MPC-1000C to the power mains and connect teleprinter to appropriate high level loop jack or low level FSK output connector. Standard 2-way plugs will work in either loop jack, but a 3-way jack is provided should the teleprinter be wired with a tip/ring type plug.

5. Turn the MPC-1000C ON and observe that the front panel LOOP LED indicator is lit, indicating that the TU is turned on and that at least 50 Ma. of loop current is flowing thru the teleprinter.

6. If Autostart operation is desired, plug the power cord from the teleprinter's motor into the PRINTER power connector on the rear panel of the TU, place MOTOR switch in AUTOSTART and select either MARK or FSK Autostart control.

7. Place the mode switch in the MS-REV position. Teleprinter should print a continuous string of RYs. If not, consult SECTION VI (MODE SWITCH) and SECTION IX (RY GENERATOR).

8. Switch the mode switch to MS (Mark-Space Diversity) and connect audio input line from receiver to audio input connector on rear panel.

   The MPC-1000C has a balanced and isolated 600Ω input matching transformer and should be driven by a 500 to 600Ω line for best performance. An unbalanced line may be used. The input impedance of the primary of this audio transformer may be changed to values lower than 600Ω if required. Please refer to the LEVEL CONTROL portion of Section VI.

9. The MPC-1000C is now set up for basic operation and the additional front panel controls are self explanatory.

SECTION III

GENERAL DESCRIPTION

The DOVETRON MPC-1000C Multipath-Diversity RTTY Terminal Unit is basically two identical low-frequency, single-conversion, solid-state receivers, whose outputs drive a MULTIPATH CORRECTOR™ circuit, which in turn, drives a high level keyer that outputs directly to a teleprinter.

Internal calibration adjustments permit the front panel VFOs to cover any 1900 Hz. segment between 100 Hz. and 4000 Hz.

An integral 2 inch CRT cross display indicates the Mark tone as a horizontal trace and the Space tone as a vertical trace. The selectivity of the channel filters and the scope amplifiers is such that time and frequency dispersions are readily apparent on the screen of the CRT.

The IN-BAND DIVERSITY mode of operation is automatic and single-channel (Mark-only or Space-only) copy is possible when one channel is lost due to deep selective fading or MAB (Make and Break) transmission modes as used in some satellite repeater operations.

In addition to Automatic Mark-Hold, Anti-Space and Anti-CW functions, the MPC-1000C also incorporates an ANTI-MARK-FADE (AMF) circuit that prevents false start pulses being generated by fast fades of the Marking pulse during slow speed (keyboard) operation.

A dual autostart circuit permits operator selection of auto-starting on a Marking carrier or on a signal with Mark-Space transitions. Neither mode responds to a continuous or keyed spacing carrier. The Mark mode does not respond to a spacing carrier, keyed or continuous.

Additional features provide for an external scope, external regeneration and code conversion, as well as diversity operation of two or more MPC-1000C terminal units without the use of a separate diversity combiner. The IN-BAND DIVERSITY capability of the MPC-1000C provides quad-diversity performance with only two terminal units, two receivers and two antennas.

The MULTIPATH-CORRECTOR™ circuit is an asychronous regenerator that restores the proper Mark-Space transition points on RTTY signals that have been stretched or smeared by HF multipath propagation.

Capable of operating in excess of 50,000 baud, and taking its timing from the incoming signal, the MULTIPATH CORRECTOR™ circuit requires no internal or external clocks. No adjustments are required when changing speed.

Additional features include an internal high level loop supply (120 volts DC at .060 amps), two low level FSK voltage level outputs (EIA RS-232C and MIL STD 188C), and a phase-continuous sine-wave AFSK tone generator with an output of 60 Mv, peak to peak.

The Mark and Space tones of the AFSK tone generator are independently adjustable at the rear panel over the range of 1200 Hz. to 3100 Hz.

Other features include a front panel LED Signal Loss Indicator, remote controls for transmit, receive and standby functions, a LOCK line on transmit and two high level keyer output jacks.

The Signal Loss circuit is also buffered to the rear panel and may be used for system control or alarm circuits.

A proprietary Multipath Combiner circuit provides fully automatic operation of the MULTIPATH CORRECTOR™ under multipath signal conditions, as well as correlation and cancellation of noise.

Provision has also been made for the attachment of UART peripherals.

Normally wired for 110 volts, 40 Hz. to 400 Hz., single phase, simple internal jumper changes provide 220 volt operation.

Package size is 17" wide, 3.5" high and 9" deep. The cabinet is available in either a table-top or standard EIA 19" rack mounting configuration. Either unit weighs 11 pounds.

SECTION IV

SPECIFICATIONS

INPUT IMPEDANCE:	600Ω, balanced and isolated. Adjustable to lower impedances.
INPUT LEVEL:	1 volt RMS Nominal. Useable from 5 millivolts to 25 volts RMS.
INPUT RATE:	45 to 75 baud. Field adjustable to other baud rates.
MARK-SPACE TONE FREQUENCIES:	Variable from 1200 to 3100 Hz. with calibration points at 1275, 1360, 1445, 1575, 1700, 1870, 2000, 2125, 2295, 2425, 2550, 2775 and 2975 Hz.
OUTPUT CIRCUITS:	High level solid-state neutral keyer with internal 120 volt DC loop supply. Current selectable and adjustable for 20, 40 and 60 mil operation.
	Polar Keyer (PKC-100) option provides ±60 VDC at 20 mils. Current range adjustable .
	EIA RS-232C FSK voltage levels, 1KΩ output Z. Mark: -12vdc. Space: +12vdc.
	MIL-STD-188C FSK voltage levels, 1KΩ output Z. Mark: +6vdc. Space: -6vdc.
	Phase continuous, sine-wave AFSK tone generator. Output level: 60 millivolts with 470Ω output Z. Tones independently adjustable at rear panel from 1200 Hz. to 3100 Hz. Balanced and isolated output option available.
	Ext. scope connectors for dual-trace signal analysis.
	Ext. connectors for regeneration, code conversion, crypto and speed changing peripherals.

Ext. connectors for dual-diversity use of two or more MPC-1000C terminal units without the need for an external diversity combiner.

Power connector for teleprinter's motor for autostart operation.

POWER REQUIREMENTS: 100 to 130 VAC or 200 to 260 VAC, internally selectable, 40 to 400 Hz., single phase, 25 watts.

POWER CORD: Standard detachable three-wire polarized cord.

TEMPERATURE RANGE: Operating: 0°C to 50°C.
Storage: -55°C to +165°C.

PHYSICAL DESCRIPTION

DIMENSIONS: Table-top: 17" wide, 3.5" high and 9" deep.
Rackmount: 19" wide, 3.5" high and 9" deep.

WEIGHT: 11 pounds operating.

SERVICING: The top and bottom covers are removable for maintenance. All internal adjustments are available from the top.

MAINTENANCE: Scheduled maintenance required: None.

KNOBS: Black insulated plastic.

RACKMOUNT: Standard EIA with mounting holds on 3.0" centers.

SECTION V

THEORY OF OPERATION

The MPC Series RTTY Terminal Units consist of two identical VLF (Very Low Frequency) AM superheterodyne receivers, in which the IF filters are analogous to the channel filters (Mark and Space) in conventional terminal units.

These Bessel Function, 3 section channel filters are identical in all respects including center frequency (750 Hz). The incoming Mark and Space tones are heterodyned into them thru full-wave J-Fet mixers. In this way, both channels are subjected to the same amount of group delay, transient response and other anomalies, thus maintaining the signal information in the same form for eventual processing.

The CRT Cross Display derives its information from the final stage of the channel filters and faithfully reproduces the actual signal content of the filters.

The Precision Detectors utilize active IC components which prevent thresholding effects and are also identical with the single exception that they are of opposite polarity. This opposite polarity of the detected Mark and Space channels permits noise cancellation at the input of the Multipath Combiner circuit.

In addition, the Multipath Combiner circuit permits automatic implementation of the MULTIPATH CORRECTOR™ in the presence of Time and Frequency Dispersion of the RTTY signals by multipath propagation. It also provides a third channel of combined Mark-Space information that is used to operate the peripheral circuits for Automatic Mark/Hold, Anti-Space, Anti-CW, Anti-Mark/Fade, and Autostart.

The Low Pass Filters are also identical, and maintain the same timing between the Mark and Space channels. Their Bessell Function design provides a "flysheel" action that aids in overcoming the error-producing pertubations normally created by fast fades and noise transients. The bandwidth of the terminal unit is controlled by these Low Pass Filters and they are designed for 45 to 75 Baud operation. They are field-changeable for higher baud rates.

After the Low Pass Filters, the Mark and Space channels are processed thru separate AC coupled Assessor circuits, whose function is to establish the proper threshold level for each channel. It is this action that permits the TU to automatically copy from a single channel: IN-BAND DIVERSITY. This feature also permits one of the channels to be inhibited by the front panel mode switch for MAB (Make and Break) operation.

The outputs of the Assessors are fed to individual Slicers, where the binary decision is made, each channel still containing all of its original information, including overlap and smear.

The binary information is now entered into the MULTIPATH CORRECTOR™ which acts as a regenerator and restores the proper zero crossings and presents the final composite binary signal to the low level and high level keyer stages.

Peripheral circuits provide automatic CRT intensity control, keyboard actuated autostart, signal loss alarm and dual-diversity comparison.

A front panel photocell connected across the Intensity control of the CRT provides high intensity in a high light environment and automatically reduces the CRT's intensity in a low light environment.

Keyboard Actuated Autostart permits the local teleprinter's motor to be turned on by pressing the Break button on the local keyboard.

The Signal Loss Circuit lights a front panel LED whenever the terminal unit goes to Automatic Mark-Hold and no signal is present in the Mark channel. A change of state is also applied to a rear panel connector for remote alarm purposes, etc.

Both the Mark and Space Precision Detector ci. cuits contain a comparator input permitting two or more Dovetron terminal units to be used in a diversity configuration.

SECTION VI

CIRCUIT DESCRIPTIONS

LEVEL CONTROL

The LEVEL control (R172) on the front panel is an attenuator that is used to set the audio input to the terminal unit at a convenient level after the desired audio level of the companion receiver has been selected.

Location R172A is provided to permit padding of the impedance of the LEVEL control to a lower value, effectively lowering the input impedance of an audio input transformer. As an example, the input impedance of the 600Ω input transformer in the MPC-1000C may be reduced to 450 ohms by installing a 5000 ohm, 1/4 watt, 5% resistor at location R172A.

INPUT IMPEDANCE

The input impedance of the MPC-1000C is an isolated and balanced 600 ohms. Transformer coupling is used to assure high common mode rejection over long lines associated with communication centers. It may be used with unbalanced lines.

INPUT AMPLIFIER

The input amplifier Z2 is AC coupled from the output of the Level pot R172, and is protected from voltage transients by a pair of back-biased diodes. This input may be driven to 50 volts without damage to the diodes or Z2. The gain of the input amplifier is adjustable by a PC board pot (R1) over a range of 2.5 to 50. This pot is nominally set at midscale for a gain of 25, and may be increased or decreased as needed.

The output of this amplifier drives one input of a full wave mixer in each channel and a unity gain inverter (Z3), which, in turn, drives the other input of the full wave mixer in each channel.

MIXER STAGES

Each Mixer consists of a pair of J-Fet transistors. Q1 and Q2 drive the Space channel thru buffer amplifier Z8 and Q3 and Q4 drive the Mark channel thru buffer amplifier Z9.

BUFFER AMPLIFIERS

The buffer amplifiers (Z8 and Z9) are set for a gain of ten and drive the channel filters.

VFO INJECTION OSCILLATORS AND INVERTERS

Both VFO Oscillators are identical and consist of an operational amplifier and an inverter for full wave output to the mixer stages. A 5KΩ pot (R145 Mark and R147 Space) is mounted on the PC board directly behind its respective front panel potentiometer for calibration of the front panel VFO controls. The frequency of the oscillators is always 750 Hz. higher than the RTTY tone frequencies.

CHANNEL FILTERS

The Mark and Space channel filters are identical and consist of three section, six pole, active IC filters utilizing precision capacitors and resistors. The center frequency of these filters is 750 Hz. with a 3 DB bandwidth of 85 Hz. The filter design is linear phase (Bessell Function) with constant group delay. This prevents pulse distortion in the filters during periods of frequency dispersive multipath distortion.

CRT CROSS DISPLAY

The output of the channel filters is fed directly to the input amplifiers of the 2 inch CRT cross display with no additional filtering. The CRT accurately displays the signals present in the channel filters.

BUFFER AMPLIFIERS

The output of the channel filters is also routed bo the Output Buffer Amplifiers (Z13 and Z21), which drive the Precision Detectors thru the front panel Normal/Reverse switch. Operating with a gain of 1.3, the buffer amplifiers also drive the LED drivers Z35 and Z48, which in turn drive the Mark and Space LEDs on the front panel.

LED DRIVERS

The drive signal on the front panel LEDs is AC and no consideration need be given to polarity if the LEDs should require replacement.

PRECISION DETECTORS

The Precision Detectors consist of two op-amps (Z14/Z15 Mark and Z22/Z23 Space), which provide full-wave envelope detection of the Mark and Space signals. The op-amps maintain the diodes in conduction and no thresholding or cut-off occurs on weak signals.

The only exception to the rule of "identicalness" occurs in these Precision Detectors. The Mark and Space signals are detected such that the outputs have opposite polarities, which permits cancellation of noise and overlapping signals at the Multipath Combiner.

The outputs of the Precision Detectors are fed to the Low Pass Filters and are also available at the rear panel Diversity connectors. This method of diversity combining within the terminal unit does away with the need for an external combiner when two TUs are used in Dual Diversity and almost always assures that the best signal in either TU is in control during Dual Diversity operation.

LOW PASS FILTERS

The Low Pass Filters are identical, linear phase, active (four RC sections) filters which have been carefully tailored to provide optimum bandwidth for 45 to 75 baud operation. Unlike other filters, this filter is very tame in the presence of impulse noise and will not ring, but rather "flywheels" thru impulse noise and other signal distortions, such as fast fades and phase cancellations.

MULTIPATH COMBINER

The Multipath Combiner circuit is driven by the Mark and Space low pass filters, consisting of Z26, Z27 and Z29, and provides three distinct functions:

1) Passes the Mark and Space signals on to the AC Assessors as received from the Low Pass Filters in the presence of time and frequency dispersive multipath distortion without combining the Mark and Space channels.

2) Provides noise cancellation and combined Mark/Space information to the AC Assessors under normal (no distortion) conditions.

It is the combination of these two functions that accomplishes automatic operation of the MULTIPATH CORRECTOR™ circuit.

3) Drives a DC coupled common mode amplifier (Z38) that in turn provides peripheral functions outside of the main data string, such as Autostart, Automatic Mark-Hold, Anti-Space, Anti-CW and Anti-Mark/Fade.

Since the outputs of the LPFs are of opposite polarities (as determined by the opposite output, polarities of the Precision Detectors), simultaneous information coming from the LPFs is essentially cancelled or highly attenuated, but normal Mark and Space signals (sequential in nature) are passed thru without attenuation.

In operation, the output of the Mark and Space low pass filters are combined at Pin 6 of Z26, TP3.

Simultaneously, the separate outputs of the Low Pass Filters are also maintained uncombined with Mark information going to Pin 2 of Z27 and Space information going to Pin 2 of Z29.

Since Z26 is operating with a gain of 2.2, its output from Pin 6, as presented to Pin 2 of either Z27 or Z29, is dominant.

Under conditions of multipath distortion, when the Mark and Space pulses are smeared or stretched in time or frequency, their overlapping portions are cancelled or highly attenuated by Z26 and do not show up at the output, but the original Mark and Space pulses are still passed directly to Z27 and Z29 thru their respective input resistors R67 and R79.

Thus it can be demonstrated that with normal signals, Z27 and Z29 are being driven mainly by signals from Pin 6 of Z26, and that signal combining has taken place and noise cancellation has been achieved thru amplitude summing of the opposite signal polarities at Pin 3 of Z26.

This is the function that permits copy of RTTY signals buried in the noise, because most of the noise is being cancelled, and only the wanted signal is passing thru Z26 unattenuated.

It can also be shown that if the Mark and Space pulses are stretched, the overlapping portions of these signals are also highly attenuated, and now the buffers Z27 and Z29, which are receiving information directly from the LPFs via R76 and R79, still have their information intact, uncombined and ready for processing by the AC Assessors, Slicers and the MULTIPATH CORRECTOR™ circuit.

The output of the combining amplifier Z26 (TP3) supplies combined Mark and Space information to the DC coupled common mode amplifier (Z38) for the peripheral functions mentioned earlier.

An offset voltage may be set into this stage (Z26) via the Combiner Offset (R22) control mounted on the PC board, which permits setting the Mark mode of Autostart for Fast or Slow response, and which also sets the noise immunity level for the Mark autostart and automatic Mark-Hold circuits.

AC ASSESSORS

The outputs of the buffers drive a pair of identical AC coupled Assessor circuits which are similar to automatic threshold correctors (ATC) circuits. The advantage of the Assessor over the ATC is that the Assessor is AC coupled and a continuous tone in either channel will not cause large amounts of bias distortion. In this manner, the MPC-1000C will continue to copy in a single channel mode automatically when an interfering tone is present in the other channel.

The time constant of the Assessor circuit is set nominally at 200 milliseconds and is a good compromise between the slow flat-fade and the fast selective-fade rates that accompany HF propagation.

SLICERS

The output of each assessor circuit drives an IC operational amplifier configured as a Slicer with a small amount of fixed hysteresis. The outputs of the Slicers are DC coupled directly to the MULTIPATH CORRECTOR™ circuit and are available at TP4 and TP5.

MULTIPATH CORRECTOR CIRCUIT

The MULTIPATH CORRECTOR™ (MPC) consists of four identical CMOS (Z31, Z32, Z33 and Z34) DIP packages and functions as a regenerator that runs at the baud rate of the incoming signal. Since it is capable of responding to baud rates as high as 50,0000 baud, no changes or adjustments are required in the terminal unit when signal speeds vary.

In addition to determining the correct position for the Mark/Space transitions in the presence of pulse stretching (overlapping), it also maintains the teleprinter in synch by latching the stop pulse, thus preventing a "legitimate" hit from generating a string of unnecessary hits.

The output memory of the MPC drives a third op-amp Slicer Z36 (TP6), which in turn, drives the output keyer circuits.

OUTPUT KEYERS

The keyer driver Q6 is emitter-coupled thru a total impedance of 2KΩ to the base of the high level loop keyer, Q7. This impedance consists of two 1KΩ resistors R199A and R199B outputted to E points 68 and 70, which are wired to the rear panel REGEN connectors J12 and J13. A jumper inside the terminal unit, across J12 and J13, completes the signal path between Q6 and Q7.

Removing this jumper permits an external receiver-type regeneration peripheral to be connected between the keyer driver and the high level loop keyer stages. The 1KΩ resistors (R199A and R119B) provide impedance buffering to the outside world and prevent accidental damage to Q6 and Q7.

INTERNAL LOOP SUPPLY

The 120 VDC internal loop supply may be strapped on the main PC board for either 20 Mil or 40-60 mil neutral operation. These strap locations are just to the left of the two power resistors R168A and R168B.

Unless specified at time of order, Dovetron MPC-1000C are factory-adjusted for 60 mil operation.

For 60 mil operation, jumpers are installed at locations A and B, and R170, which is a voltage setting shunt across the front panel LOOP LED, is 33 ohms.

When the rear panel loop pot R169 is adjusted for 40 mil operation, it may be necessary to change R170 to 68 ohms to maintain a higher brilliance of the LOOP LED.

For 20 mil operation, a single jumper is installed in location C (jumpers in A and B are removed) and R170 is 100 ohms.

If the PKC-100 Polar Keyer option has been installed, the internal loop supply is used to provide the proper positive and negative polar voltages and the required polar currents.

Consult Dovetron Assembly Print 75152 and the PKC-100 Instruction insert at rear of manual.

FSK VOLTAGE LEVEL OUTPUTS

Two FSK voltage level outputs are available simultaneously: EIA RS-232C and MIL STD 188C.

EIA RS-232C is generated by Z45, which is driven by the low side of the high level loop supply: Mark: -12 volts, Space +12 volts. Output impedance: 1KΩ.

MIL STD 188C is generated by Z46, which is driven by the EIA FSK circuit. Mark: +6 volts, Space: -6 volts. Output impedance: 1KΩ.

By characteristic, these outputs are inverted in respect to each other, providing the operator with either polarity for Mark and Space, as required by his installation.

AFSK TONE KEYER

An Exar XR2206C (Z43) function generator provides phase-continuous, sine-wave AFSK Mark and Space tone signals suitable for driving the audio input stage of SSB, FM, PM and AM transmitters. This tone keyer is keyed by the output of the EIA FSK circuit, which is connected thru a jumper installed between AFSK INPUT (J7) and EIA FSK (J6).

This jumper may be removed, permitting the AFSK tone keyer to be keyed by a peripheral device via the AFSK INPUT connector on the rear panel. The EIA FSK output may be used to key the peripheral.

The Mark and Space tones of the tone keyer are independently adjustable over the range of 1200 Hz. and 3100 Hz. PC board pots provide a coarse adjustment, and the rear panel lock-pots provide a vernier adjustment.

The output level at the rear panel AFSK OUTPUT connector (J10) is 60 millivolts (peak to peak) and the output impedance is nominally 470 ohms resistive.

The output level and the output impedance may be modified by changing the value of the voltage divider R148/R149, or adding R204 at the output connector.

CW IDENTIFICATION

Provisions have been made for Narrow or Full CW ID on AFSK. The narrow CW ID is approximately 100 Hz with jumper A-B. When the jumper (B-A-C) connected to E56 is arranged B-C, Full-Shift CW ID is provided. This arrangement also provides keying of the EIA and MIL FSK stages.

Narrow shift CW ID keying of the EIA FSK stage is available by connecting J9 to E59 in place of the factory-installed connection to E56. No provision has been made for narrow-shift CW ID keying on the MIL STD 188C FSK line, but moving the high end of R160 from E62 to E61 will accomplish this.

LOW VOLTAGE POWER SUPPLIES

The +15 and -15 volt power supplies are regulated with independent voltage regulators that have internal over-current and over-temperature protection circuits built-in (Q8 and Q9). In the event of a short circuit on either supply line, the affected regulator will shut down without damage and will stay down until the over-load condition is cleared.

These regulators are mounted on the bottom side of the printed circuit board and are adequately heat-sinked with their mounting hardware. Both regulators are diode-protected against latch-up at turn-on.

POWER MAINS

The MPC-1000C may be powered from either 110 or 220 VAC, 40 to 400 Hz., single-phase power mains. The proper power is engraved on the rear panel directly below the power cord connector.

To convert from one line voltage level to the other, remove the top and bottom covers, and locate the jumpers installed next to the power transformer. One jumper is required for 220 VAC operation and two jumpers are required for 110 VAC operation.

The power available at the PRINTER connector for the motor of the companion teleprinter is always the same as the primary power being supplied to the TU.

The third wire ground in the power cord should always be tied to a good system or earth ground for maximum performance.

FUSES

The primary power is fused with a single Slo-Blo fuse:

110 Volts:	0.5 amps
220 Volts:	0.25 amps

The loop supply is fused with a 0.1 amp fast blow fuse. Although the loop supply is limited to 70 Ma by design, the fuse will protect the internal loop supply from overload should an external loop supply be plugged into the circuit.

The high voltage winding for the CRT's power supply is fused with a clip-in 1/32 amp slo-blow fuse (F3) located underneath the power transformer on the bottom side of the PC board.

DOT DEFLECTION CIRCUIT

The diode bridge (CR44) and Q12 form the dot deflection circuit. In the absence of a signal or noise, the center dot will be deflected to the bottom of the CRT's screen and defocused by the longer focal distance, preventing a burn spot in the center of the screen. The time constant of the dot deflection circuit is such that it will permit the dot to follow slow flat fades of weak RTTY signals and is indicative of signal path conditions.

A 7.5 volt zener (400 milliwatt diode (not normally installed) at CR53 will provide a faster than normal dot deflection upon loss of signal. The zener is used to prevent C65 from charging to full value, thus decreasing the time required for this cap to discharge to zero.

To fix the dot in the center of the screen at all times, remove Q12 from its socket and insert a jumper wire between the Collector and Emitter holes in the socket. Caution: The Collector circuit has +350 volts on it when operating.

CRT CROSS DISPLAY CIRCUITS

The 2 inch CRT Cross Display is driven by the final stage of the channel filters and displays a true picture of what information is contained in the filters. The Mark and Space channel amplifiers (Q10 and Q11) are DC coupled from the outputs of Z12 and Z20.

The gain of each amplifier is controlled by a PC board pot (Mark R180 and Space R173). Other variable controls located on the PC board are: Focus, Intensity, Astigmatism, Horizontal Centering and Vertical Centering. Caution: These controls have +350 volts on them.

A front panel photocell automatically adjusts the intensity of the CRT as the ambient light level at the operating location changes. This photocell is in series with a 62KΩ resistor (R222) and both are electrically shunted across the Intensity control on the PC board.

The response of this circuit to ambient light levels can be adjusted by changing the value of R222 or adjusting R195. Caution: This circuit operates at -140 VDC.

THRESHOLD CONTROL

The front panel THRESHOLD control sets the hysteresis level on the common mode amplifier (Z38) and the pulse width discriminator (Z39). These control the threshold level of the automatic Mark-Hold circuit and the FSK autostart circuit. A 12 o'clock setting is considered normal. The automatic Mark-Hold feature is defeated by rotating the THRESHOLD control to full counter clockwise (CCW).

The main purpose of the Threshold control is to force the TU to run "open" on noise when copying very weak signals. The Signal Loss LED is a convenient indicator of the proper threshold setting.

AUTOMATIC MARK HOLD THRESHOLD

The Auto-Mark/Hold function may be inhibited by turning the front panel THRESHOLD control fully CCW. This will force the terminal unit to run "open" on noise and is often desirable when copying very weak signals at the threshold of noise.

This mode of operation is often used on machine speed commercial circuits where the Mark-Hold function in the terminal unit is provided entirely by the Marking carrier.

COMMON MODE AMPLIFIER

The Common Mode Amplifier (Z38) has both of its input ports tied to the output of the Multipath Combiner Amplifier and is very tame in the presence of input noise. When the output of the Multipath Combiner Amplifier goes high on a Marking signal, the Common Mode Amplifier changes state and drives a pulse width discriminator. The threshold level of the Common Mode Amplifier is set by the front panel THRESHOLD control, which injects a small amount of hysteresis.

PULSE WIDTH DISCRIMINATOR

The time constant of the Pulse Width Discriminator, which is used for Auto-Mark/Hold, Anti-Mark/Fade, Anti-Space, Anti-CW and FSK Autostart, is set by the values of C47 and R119.

The factory installed value of R119 is 180KΩ (5%), and provides a time constant of approximately 200 to 220 milliseconds.

With this timing, very fast response to unwanted signals is provided in the Anti-CW and Anti-Space functions. If the timing is too fast, the Automatic Mark/Hold circuit might have a

tendency to put the terminal unit into Mark-Hold during the last character bit (the 5th bit) of the character BLANK, which is comprised of six spacing bits; five character bits plus the Start (spacing) bit.

This anomaly of printing the character O instead of BLANK will only occur at 45.45 Baud (60 WPM), and if it occurs, and is objectionable, R119 should be increased in value to 240KΩ, 5%.

SIGNAL LOSS INDICATOR

The Signal Loss circuit and amplifier (Z37) receive "state" information from Z36, which is the slicer on the output of the MULTIPATH CORRECTOR™, from Z39, which is the output of the pulse width discriminator, and from Z26, the Multipath Combiner amplifier.

When Z37 senses a Mark-Hold condition with no marking carrier in the Mark channel, it signals that an RTTY signal is no longer present and indicates "signal loss" by turning on a front panel LED indicator. This information is also buffered thru a 1KΩ resistor to the rear panel for system alarm and control purposes.

Placing the Standby Switch to the Standby position also forces the Signal Loss LED indicator on.

In those units with a bipolar Green/Red LED, Green indicates a signal is present, and Red indicates a signal loss condition.

MODE SWITCH

The Mode Switch has five positions:

1) DIV OFF: Diversity Off.
2) MO: Mark Only.
3) MS: Mark-Space (Normal).
4) SO: Space Only.
5) MS-REV: Mark-Space Reversals.

The DIV OFF position is the same as MS, which is normal Mark and Space operation, but if two MPC-1000Cs are connected together for Dual Diversity operation, the DIV-OFF position disconnects their interconnecting circuits and permits both TUs to be used independently.

MO and SO permit either Mark-only or Space-only operation by shutting down the local injection oscillator in the opposite channel.

MS is the normal operation mode and permits full automatic In-Band Diversity operation of the TU. If one channel should fade into the noise, the TU automatically derives all of its data from the other channel by use of the Assessor circuit in the working channel and from a psuedo channel that is automatically generated in the Multipath Combiner circuit.

The MS-REV position activates a square generator that drives the AFSK tone keyer, and routes the tones from the tone generator into the front end of the TU. When the square wave generator is set to one half of the baud rate of the companion teleprinter, the teleprinter will print a continuous string of RYs. Example: 45.45 baud = 22.8 Hz.

The RY (MS-REV) generator is adjusted by R163.

The frequency of the RY generator may be read by a frequency counter at the EIA or MIL FSK output connectors on the rear panel.

If the RY Generator is running slightly fast or slow, the teleprinter will have a tendency to print a string of Ys. If an external UAR/T type regenerator is being used, the teleprinter will print only Ys because the regeneration technique of the UAR/T will not permit "loading" a string of Mark-Space Reversals in any sequence other than Ys.

AUTOSTART

In the FSK Autostart mode, the autostart timing circuits are driven by the previously described common mode amplifier and the pulse width discriminator circuit. Both the LEVEL control and the THRESHOLD control have some influence on the turn-on time and time-out characteristics of the FSK auto-start.

This mode of operation is intended to monitor and shut off the teleprinter's motor during the long marking periods common to commercial press and weather station.

Turn-on is accomplished in a few characters and time-out is approximately 20 seconds.

In the MARK Auotstart mode, the autostart timing circuits are driven by the output of the Multipath Combiner amplifier. Although the LEVEL control has a little bit of influence, the THRESHOLD control has no influence over turn-on or time-out.

This mode of operation is less susceptible to false turn-ons by noise pulses and times-out in approximately seven seconds.

The time-out period of both modes is a function of C1 and R131 and may be changed to suit the operator's preference.

The Mark mode of Autostart is also affected by the offset voltage at Z26 as created by the Combiner Offset control R221. The greater the offset, the more immunity to noise pulses, but the turn-on time to a Marking carrier will be slower.

The Mark mode is also immune to a CW signal, keyed or continuous, in the Space channel.

AUTOSTART RELAY CIRCUIT

The relay driver Q5 is driven by Z42, when the front panel MOTOR Control switch is in the AUTOSTART position. In the MOTOR OFF position, the relay cannot be actuated. In the MOTOR ON position, the relay solenoid is grounded thru the MOTOR control switch.

SECTION VII

BLOCK DIAGRAMS

THE FOLLOWING BLOCK DIAGRAMS ARE NOT COMPLETE. THEY ARE MEANT FOR REFERENCE USE ONLY.

PAGE 24: Input Amplifier, Inverter, Full-Wave Mixers, VFO Oscillators, Buffer Amplifiers and Channel Filters.

PAGE 25: CRT Cross Display, Amplifiers, Dot Deflection Circuit, Normal/Reverse Switch, LED Drivers, Precision Detectors and Low Pass Filters.

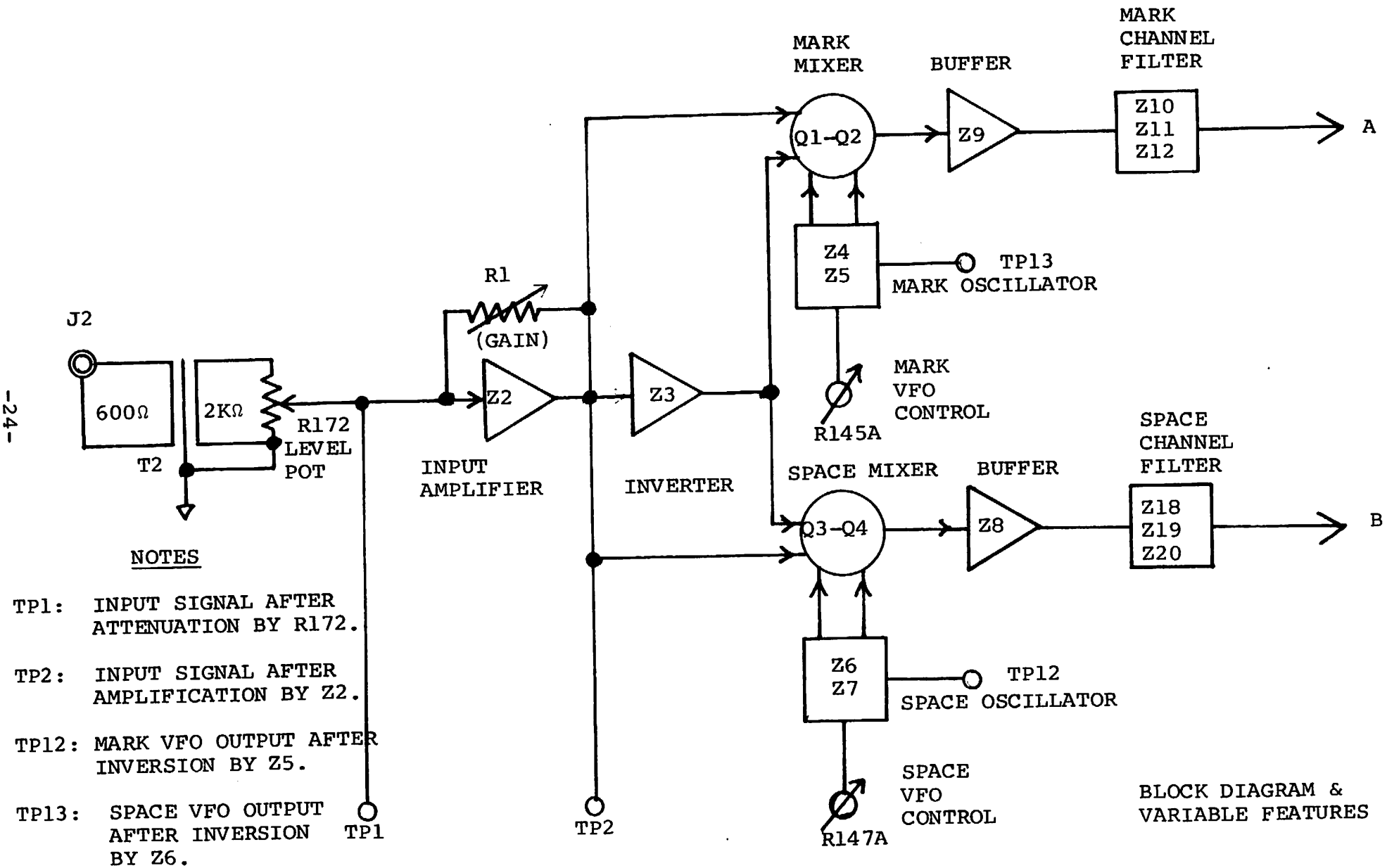
PAGE 26: Multipath Combiner Circuit, Assessors, Slicers, MULTIPATH CORRECTOR™, Slicer and Voltage Regulators.

PAGE 27: Driver, REGEN IN/OUT Circuit, High Level Loop Keyer, Internal Loop Supply, EIA RS-232C and MIL STD 188C FSK Outputs, LOOP LED circuit, RY GENERATOR AND AFSK Tone Keyer.

PAGE 28: Common Mode Amplifier, Pulse Width Discriminator, FSK Autostart, MARK Autostart, Autostart Trigger-Driver-Relay Circuit, Signal Loss Amplifier and Automatic Threshold Level Control circuit.

Circuits not included in these diagrams are:

Remote Control, CRT Power Supplies, MO and SO switching, Automatic CRT Intensity Control, Automatic Threshold Level Control in MO/SO modes and Keyboard Actuated Autostart.



NOTES

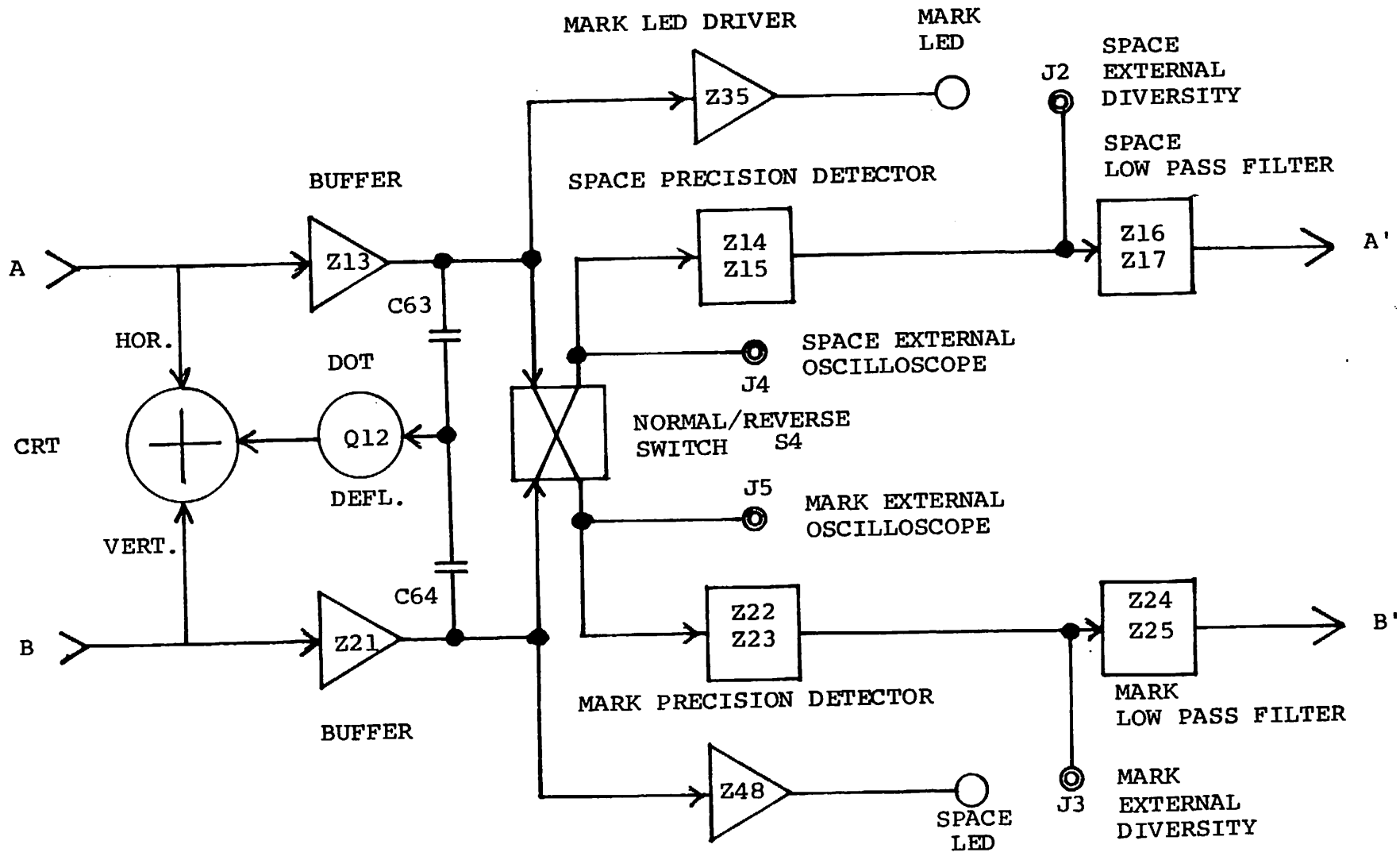
TP1: INPUT SIGNAL AFTER ATTENUATION BY R172.

TP2: INPUT SIGNAL AFTER AMPLIFICATION BY Z2.

TP12: MARK VFO OUTPUT AFTER INVERSION BY Z5.

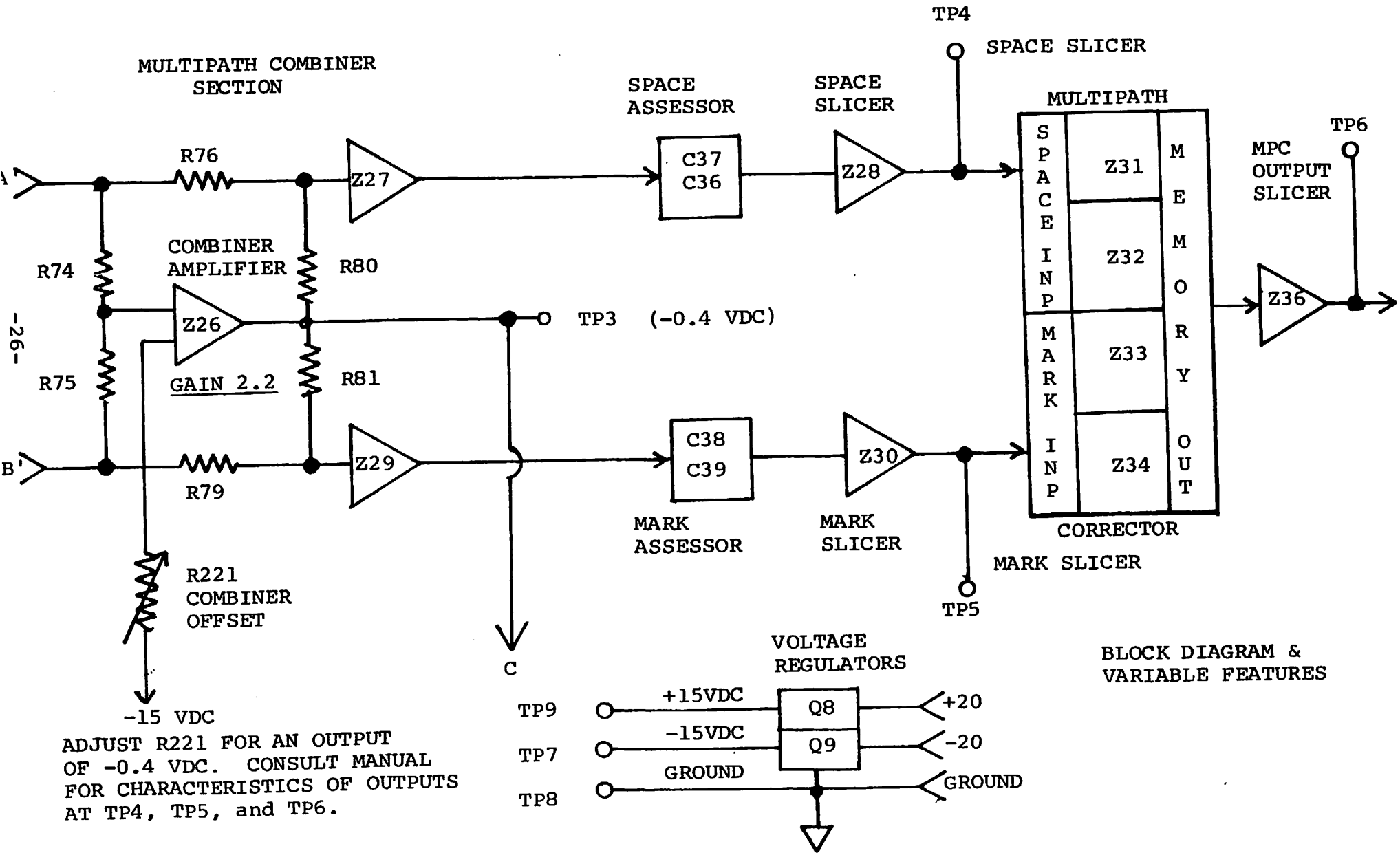
TP13: SPACE VFO OUTPUT AFTER INVERSION BY Z6.

BLOCK DIAGRAM & VARIABLE FEATURES



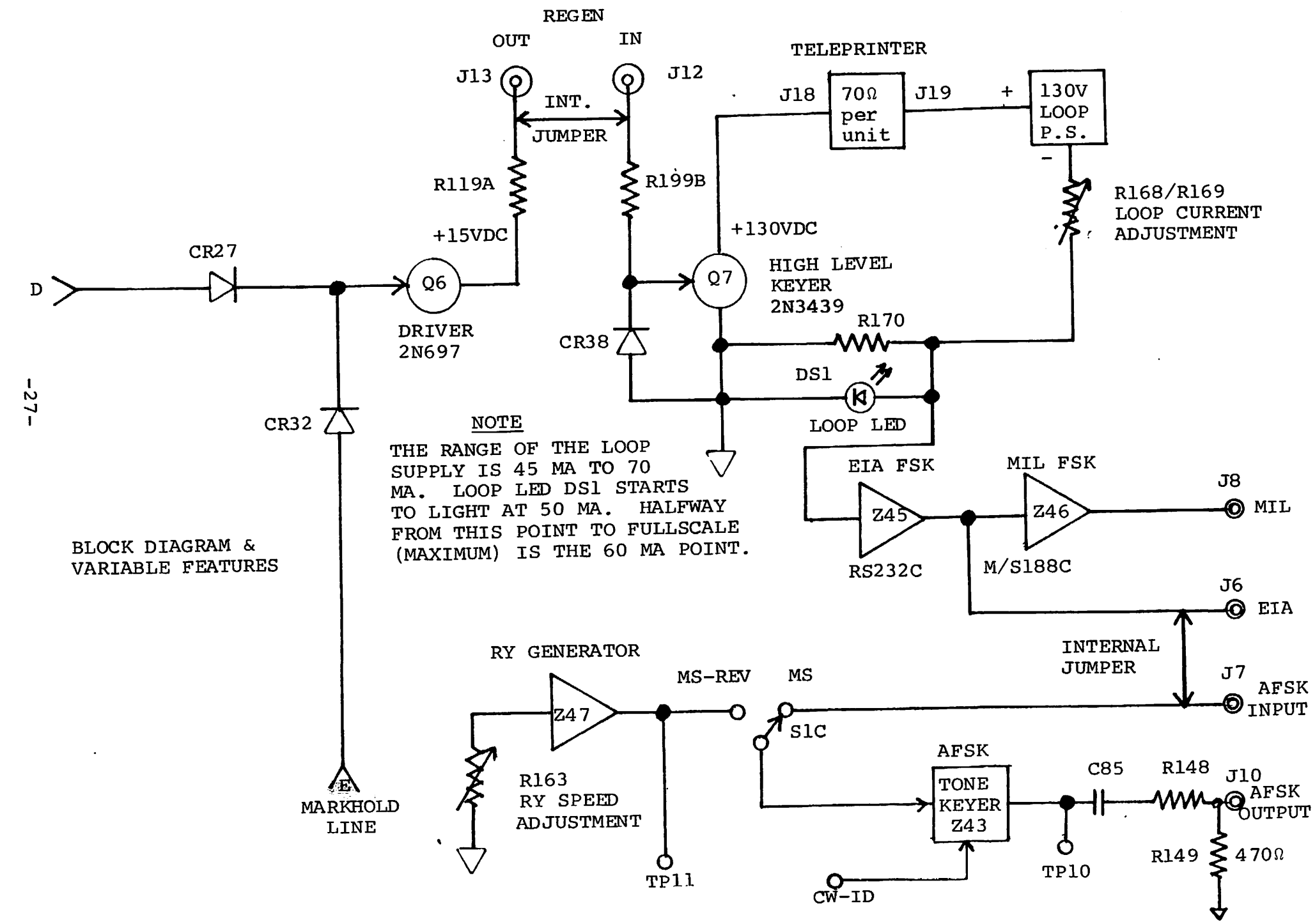
BLOCK DIAGRAM & VARIABLE FEATURES

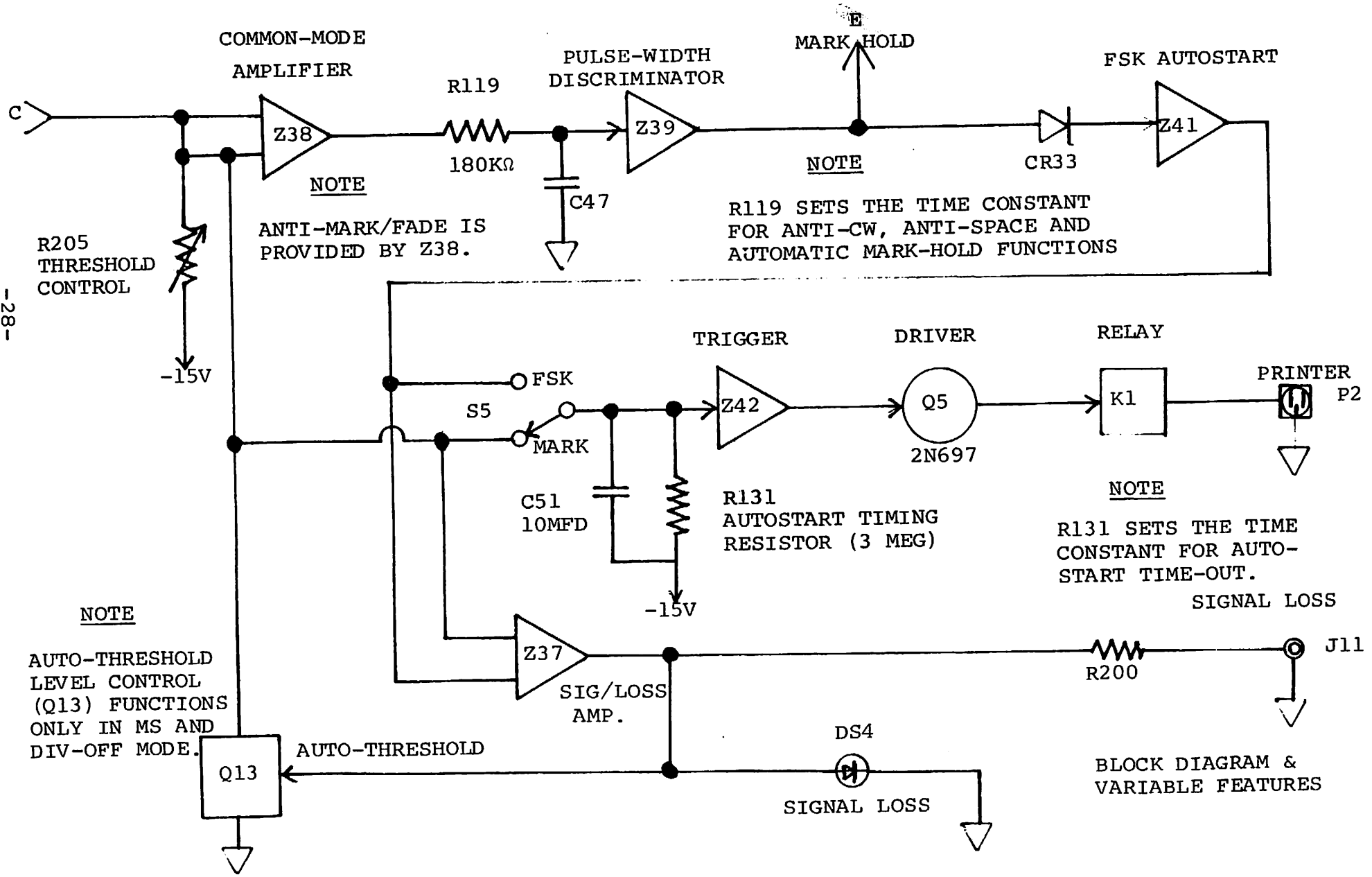
THE EXTERNAL SCOPE AND EXTERNAL DIVERSITY CONNECTORS AT THE REAR PANEL MAY BE USED FOR CONVENIENT TEST POINTS FOR TROUBLE SHOOTING OF THE VARIOUS STAGES.



ADJUST R221 FOR AN OUTPUT OF -0.4 VDC. CONSULT MANUAL FOR CHARACTERISTICS OF OUTPUTS AT TP4, TP5, and TP6.

BLOCK DIAGRAM & VARIABLE FEATURES


REGEN
OUT
IN
J13
J12
INT.
JUMPER
TELEPRINTER
J18
70Ω per unit
J19
+
130V LOOP P.S.
-
R119A
R199B
R168/R169
LOOP CURRENT
ADJUSTMENT
+15VDC
+130VDC
CR27
D
Q6
Q7
HIGH LEVEL
KEYER
2N3439
DRIVER
2N697
CR38
R170
DS1
LOOP LED
CR32
NOTE
THE RANGE OF THE LOOP SUPPLY IS 45 MA TO 70 MA. LOOP LED DS1 STARTS TO LIGHT AT 50 MA. HALFWAY FROM THIS POINT TO FULLSCALE (MAXIMUM) IS THE 60 MA POINT.
EIA FSK
MIL FSK
J8
MIL
Z45
Z46
RS232C
M/S188C
J6
EIA
INTERNAL
JUMPER
RY GENERATOR
MS-REV
MS
J7
AFSK
INPUT
Z47
S1C
AFSK
TONE
KEYER
Z43
C85
R148
J10
AFSK
OUTPUT
R163
RY SPEED
ADJUSTMENT
TP11
TP10
R149
470Ω
CW-ID
E
MARKHOLD
LINE
BLOCK DIAGRAM &
VARIABLE FEATURES


COMMON-MODE
AMPLIFIER
PULSE-WIDTH
DISCRIMINATOR
MARK HOLD
FSK AUTOSTART
C
Z38
R119
180KΩ
Z39
Z41
CR33
C47
NOTE
ANTI-MARK/FADE IS
PROVIDED BY Z38.
NOTE
R119 SETS THE TIME CONSTANT
FOR ANTI-CW, ANTI-SPACE AND
AUTOMATIC MARK-HOLD FUNCTIONS
R205
THRESHOLD
CONTROL
-15V
TRIGGER
DRIVER
RELAY
PRINTER
P2
FSK
S5
MARK
Z42
Q5
2N697
K1
C51
10MFD
R131
AUTOSTART TIMING
RESISTOR (3 MEG)
NOTE
R131 SETS THE TIME
CONSTANT FOR AUTO-
START TIME-OUT.
-15V
SIGNAL LOSS
NOTE
AUTO-THRESHOLD
LEVEL CONTROL
(Q13) FUNCTIONS
ONLY IN MS AND
DIV-OFF MODE.
Z37
SIG/LOSS
AMP.
R200
J11
DS4
Q13
AUTO-THRESHOLD
SIGNAL LOSS
BLOCK DIAGRAM &
VARIABLE FEATURES

SECTION VIII

REGENERATION INTERFACE

The MPC-1000C terminal unit has been designed to afford a fast and simple interface to signal regenerators, speed converters, code scramblers and other digital devices, similar to the Dovetron TSR-500 internal or TSR-1000 external Regenerator/Speed Converters.

To prepare the TU for interfacing, remove the top:

1) Locate and remove (or cut) the jumper between J12 (REGEN IN) and J13 (REGEN OUT). This completes the Receive-only modification.

2) Locate and remove (or cut) the jumper between J6 (EIA FSK) and J7 (AFSK INPUT). This second modification adds the transmit function if the regenerator has a bilateral (Xmit/Rec) mode.

The input section of the receiving regenerator will be driven by J13. The output of the Regenerator will drive the high level loop keyer via J12.

In the transmit mode, the regenerator will be driven by J6 (EIA FSK) and in turn, will drive the AFSK tone keyer in the TU via J7 (AFSK INPUT).

All four ports are impedance buffered and have the following signal characteristics and requirements:

J13-REGEN OUT: +13 volts Mark, zero volts Space. 1KΩ resistive.

J12-REGEN IN: +5/+15 volts Mark, zero or less volts Space. 1KΩ resistive.

J6-EIA FSK: -15 volts Mark, +15 volts Space. 1KΩ resistive.

J7-AFSK INPUT: Less than +0.5 volts Mark, more than +2.5 volts Space. 20KΩ resistive.

The MIL STD 188C FSK signal at J8 may be used in lieu of the EIA FSK (J7) if the opposite polarity is required as a transmit drive signal to the regenerator.

The AFSK INPUT of the tone keyer is buffered by 20KΩ (R152) and this value may be decreased if any difficulty is encountered in driving the tone keyer from the regenerator. The tone keyer switches from Mark to Space at approximately +2.5 volts.

To return the TU to normal operation, replace the jumpers or install a shielded patch cable between J12 and J13 and another shielded patch cable between J6 and J7.

Any regenerator used with the MPC-1000C should share a common signal and power ground.

SECTION IX

CALIBRATION PROCEDURES

VFO CALIBRATION

If a frequency counter is available, it may be connected directly to the wiper of the Mark or Space front-panel VFO pot, or to TP12 or TP13. Set the front panel pot to 2125 Hz. Adjust the PC board pot directly behind the pot being calibrated to a frequency 750 Hz higher than the frequency indicated by the VFO calibration markings: 2750 Hz.

If a frequency counter is not available, the PC board pots (with power removed) may be adjusted with an ohmmeter to 2000 ohms. Final calibration is then done against a known frequency source, using the CRT cross display as an indicator.

Do not attempt to calibrate the VFOs with a frequency source without first setting the PC pots to approximately 2000 ohms, as it is possible to set the oscillators on the wrong side of the channel filters.

The stability of the local oscillators is better than 400 PPM/°C, Typically 200 PPM/°C.

AFSK TONE KEYER ADJUSTMENT

If the front panel VFO controls have been calibrated, the rear panel Mark and Space tone pots may be adjusted against the front panel VFO calibrations, using the CRT as a tuning indicator, and the RY generator (MS-REV) to switch from Mark to Space and back again. The range of the AFSK tone generator is 1200 to 3100 Hz, and coarse adjustment is provided by the two PC board pots at R208 and R210.

A frequency counter may be connected to the AFSK output connector for a more precise calibration of the Mark and Space tones.

To accomplish this, turn the LEVEL control all the way CCW and put the mode switch in MS, guaranteeing that the TU is now in Mark-Hold and generating a Mark tone.

Adjust the rear panel Mark tone pot to the desired frequency.

Open the loop circuit, forcing the tone keyer to the Space condition, and adjust the Space tone pot to the desired space tone frequency.

The loop may be opened by holding down the teleprinter's Break button, inserting an open phone plug into one of the high level loop jacks, or by removing the 0.1 amp fuse at F2.

Verify that the loop is in the Space condition (loop LED extinguished) before adjusting the Space tone pot on the rear panel.

INPUT GAIN CONTROL

The voltage gain of the input amplifier Z2 is controlled by the amount of feedback as set by R1. This pot is factory set at half-scale (250KΩ) and provides a gain of 25. It may be operator adjusted after the audio level of the companion receiver has been adjusted. The front panel LEVEL pot R172 functions as an attenuator between the receiver and the terminal unit.

COMBINER OFFSET CONTROL

The offset of Z26 is controlled by injecting a small amount of negative voltage into Pin 3 of Z26 via R221. With the LEVEL control turned full CCW, set R221 so that the offset voltage at TP3 is -0.4 volts. The offset voltage should be checked whenever an op-amp is changed in the low pass filters.

A slower response to a marking carrier when in MARK autostart and a higher immunity to false starts from impulse noise may be had by setting this offset as low as -0.6 volts.

Fast autostart on weak RTTY signals may be accomplished by setting the offset to -0.2 volts, but the MARK autostart circuit will be more susceptible to false starts from noise impulses.

SCOPE GAIN

A convenient method of setting the gain of the Mark and Space CRT gain pots is to select the MS-REV mode, turn the LEVEL pot all the way CW, adjust the front panel VFO pots to the frequency of the AFSK tone keyer, peaking them for maximum deflection in the horizontal and vertical axes, and then:

Adjust the gain pots (R173 and R180) for line lengths of 1.5 inches.

Caution: If the gain is down in one channel, due to a component failure in the front end, the CRT scope will display the loss of signal power. Before readjusting the scope gain pots, check the balance between the two channels at the External Scope connectors on the rear panel, which is the output of the buffer amplifiers immediately following the channel filters.

RY GENERATOR

When the mode switch is in the MS-REV position the AFSK tone keyer is connected to the input of the TU and the audio line from the external receiver is disconnected. The AFSK tone keyer is driven by the square wave generator, Z47.

The frequency of the square wave generator is set by PC board pot R163.

When adjusted for RY generation at one speed, RYs will not be printed at any other speed.

Select the most common speed that you intend to operate the teleprinter at and adjust R163 until the teleprinter prints a continuous string of RYs.

These Mark and Space reversals are balanced 50/50 and make an excellent signal source for checking the various stages of the terminal unit, for machine maintenance, and for occupying a radio channel.

When used with a UAR/T type regenerator, only Ys will be printed. This is also true of some types of video displays and solid state teleprinters, because their center-sampling techniques do not permit decoding an "R" from a string of continuous mark-space reversals.

LOOP CURRENT ADJUST

The internal high voltage loop supply may be adjusted from 30 Ma. to 70 Ma. by the rear panel pot R169.

With a normal teleprinter load of approximately 70Ω, the 60 Ma. setting is very close to mid-scale.

To set the loop current to 60 Ma. without the use of an external milliammeter, adjust the loop pot to MIN. The front panel LOOP LED should be extinguished. Turn the pot up (CW) slowly. The LED begins to indicate at 50 Ma. Since full-scale is 70 Ma., setting the pot halfway between the point where the LED begins to indicate (50 Ma.) and full-scale (70 Ma.) is 60 Ma.

SECTION X

VARIABLE FEATURES

In order to satisfy the largest possible number of requirements RTTY demodulation under varying circumstances, many variable features have been included in the MPC-1000C and are operator selectable.

CONTROLLED LIMITING

Although the MPC-1000C is a linear AM terminal unit, a form of controlled limiting takes place when the input amplifier and the various buffer amplifiers are driven into saturation.

A slight amount of limiting will not increase the error rate on good signals. For this reason, it is advisable to set the LEVEL control to a point where controlled limiting takes place on strong signals, and the moderate and weak signals are copied in a linear mode.

EXTERNAL SCOPE

External rear panel scope connectors are provided to permit dual trace analysis of the Mark and Space channel information simultaneously. This type of display provides instant recognition of signal and circuit characteristics, including multipath pulse stretching, selective fading, keying errors at the transmitting end, etc. The output impedance of the External Scope lines is 100KΩ.

EXTERNAL DIVERSITY

Two MPC-1000C Terminal Units may be interconnected for Diversity operation by jumpering the External Diversity connectors together, Mark to Mark, and Space to Space.

All diversity combining is accomplished within the two TUs and an external diversity combiner is not required.

Laboratory and field testing has shown that the stronger of the two signals in any one channel is the best choice and the combining circuits in the terminal units work in this manner.

The teleprinter may be plugged into either TU. The DIV-OFF position of the front panel mode switch is the same as the MS position, but the External Diversity lines are disconnected without having to disconnect the diversity cables at the rear panel.

REMOTE CONTROL (LOCK)

A LOCK connector is provided at the rear panel for remote control of the terminal unit.

When the front panel Standby switch is in the ON position, a +5 to +15 volt logic level at the LOCK terminal will force the TU into Mark-Hold thru diode CR50.

If CR54 is installed, the logic level at the LOCK connector will also prevent the FSK autostart circuits from timing out, i.e., the motor cannot shut off, and FSK time-out will commence only after the LOCK signal is removed.

If CR55 is installed, the logic level at the LOCK connector will also prevent the MARK autostart from timing out.

The installation of CR54 and CR55 is left to the discretion of the operator. Any signal diode similar to 1N914 is adequate.

KEYBOARD ACTUATED AUTOSTART

Diode CR34 is factory-installed. This circuit prevents the FSK Autostart from timing out as long as characters are being generated on the loop line from a keyboard, etc.

It also permits a Keyboard Actuated Autostart function. When the break button on the keyboard is momentarily depressed, the EIA FSK output switches from Mark to Space, actuates the FSK Autostart circuit for 20 seconds, and permits message retrieval from the teleprinter's typing unit.

This feature may also be added to the MARK Autostart mode by the installation of CR52, but the time-out of the Mark Autostart mode then is influenced to some extent by the setting of the front panel THRESHOLD control.

AUTOMATIC THRESHOLD CONTROL

A P-channel J-Fet (Q13) switch is actuated by an incoming RTTY signal and lowers the value of front panel THRESHOLD control by connecting R216 across R205. This circuit permits the TU to track signals taking deep fades into the noise without having to reduce the TU's THRESHOLD control.

If the signal is finally lost, the threshold level of the TU is reset to whatever level is manually set by the front panel THRESHOLD control. The time constant if this "reset" is a function of the time constant of C82 and the impedance of Q13. A faster reset is available to the operator by the addition of R214 and CR58.

A variation of this circuit consists on switch section S1F of the Mode switch and R219. When the TU is switched to MO or SO operation, the threshold level is lowered to compensate for the loss of signal power when in single channel operation.

This is meant as a convenience feature, preventing the operator from having to readjust the THRESHOLD control on weak signals if it is necessary to switch to single channel copy.

STANDBY SWITCH REMOTES

Three Remote connectors are provided on the rear panel: 1, 2 & 3.

Each remote is connected to one terminal on a SPDT section of the Standby switch. The wiper is on Remote 1 and is current protected with a 33Ω resistor R148. Remote 2 is connected to the ON position and Remote 3 is connected to the Standby position. Consult the schematic for a full understanding of the function of this switch.

Simple transmitter-receiver remote control from the TU's standby switch can be accomplished in a variety of ways.

With a VOX actuated transmitter, the AFSK tone generator output can be routed thru this switch, using the VOX circuit to turn the transmitter on when the AFSK tone is switched into the audio input of the transmitter. See KWM-2/KWM-2A section on next page.

Another example is that Remote 1 can be grounded with a shorting plug and Remote 2 and 3 can then be used to ground various switching schemes.

These remote lines are printed circuit traces on the PC board and no attempt to carry 110 VAC/VDC should be made.

REACTANCE MODULATOR KEYER

In applications, where it is desirable to key a voltage controlled oscillator, reactance modulator, etc., locations Q14 and R217 have been provided. R217 should be 10K, 1/4 W.

As an example, the FSK-1 reactance modulator keyer line of the Central Electronics 100V/200V exciters may be keyed from E87. In this particular application Q14 should be a high voltage PNP transistor such as the 2N3930. Low voltage transistors may be used for applications that do not require high voltages. The 2N3439 may be used for high voltage keying that requires a NPN transistor.

BAUD RATE CONSIDERATIONS

The bandwidth of the Terminal Unit has been designed for optimum performance over the range of 45 to 75 baud, i.e., 60 to 100 words per minute.

For higher baud rates, the bandwidth of the Low Pass Filters must be expanded by changing eight resistor locations:

R45, R46, R47, R48, R70, R71, R72 and R73.

These locations presently have 510K resistors installed.

For 110 Baud operation, change all 8 locations to 330KΩ, 5%.

For 150 Baud operation, change all 8 locations to 250KΩ, 5%.

At 150 Baud, the channel filters should also be opened up, although much of the distortion created by the "tight" filters will be corrected for in the MULTIPATH CORRECTOR™ circuit.

If the terminal unit is to be used exclusively on 45.45 or 60 Baud circuits, a slight improvement in signal to noise ratio can be achieved by narrowing the bandwidth of the terminal unit by replacing the 8 510KΩ resistors with 8 750KΩ, 1/4W, 5%.

KWM-2/KWM-2A CONSIDERATIONS

Some transceivers (Collins KWM-2/A, etc.) do not make provisions for turning off their audio input circuits during receive. By maintaining these audio circuits live, Single Sideband VOX operation is available.

When using this type of transceiver for RTTY, the Mark and Space tones from the AFSK tone keyer in the Terminal Unit will be heard in the audio background during receiving periods.

Remotes 1, 2 and 3 may be used to interrupt the AFSK tones during receive, or may be used to short the AFSK tone output to ground during receive.

In either case, the AFSK tones will not be heard in the transceiver's audio output during receive, and the TU's Standby switch can still be used to switch to "transmit" via the VOX circuitry.

Although the bandwidth of the KWM-2A is very wide (2.1 KHz), it is a superb RTTY transceiver.

The center frequency of the channel filters in the E Series MPC-1000(C) Terminal Units have been moved to 750 Hz and provide excellent image rejection when used with the KWM-2A and with the 51S1 all-band receiver and its 2.4 KHz filters.

51S1 CONSIDERATIONS

The BFO crystal in the 51S1 is mounted on top of the chassis in a crystal socket and may be easily changed.

When used in RTTY service, if the 500 KHz BFO crystal is replaced with a 498.8 KHz unit, the standard tones of 2125, 2295 and 2550 may be copied thru the 800 Hz CW filter. The USB (2.4 KHz) filter permits the standard combination of 2125 MARK and 2975 SPACE to be used.

By copying Narrow and Medium shift signals thru the 800 Hz CW filter, there is less chance of the receiver's AGC being captured by strong adjacent-channel signals.

A 502.2 KHz crystal may also be used, and LSB used for the wide-shift (2125 and 2295) operation, but since the USB and CW filter positions are adjacent to each other on the Filter Switch of the 51s1, (and since the CW filter has a USB ofset) the use of the 498.8 crystal is preferred.

SECTION XI

SERVICE INSTRUCTIONS

CAUTION: HIGH VOLTAGES ARE PRESENT IN THIS UNIT

Before removing the top and bottom covers, remove the AC power cord at the rear panel AC connector.

CAUTION: HIGH VOLTAGES ARE PRESENT IN THIS UNIT

The AC mains are exposed inside the unit at the rear of the AC input connector, on the rear of the front panel power switch, on the contacts of the autostart relay, on the fuse holder F1, and at the rear of the printer's motor connector.

The +350 and -175 volt lines for the CRT are exposed on both sides of the PC board.

The traces and wires running to the front panel photocell socket are at -140 volts.

The high level loop voltage (130 VDC) is exposed on the top of the power resistor R168 and at fuse holder F2.

If the high level loop line is open, the loop filter capacitor does not bleed to zero.

Although the electrolytic filters "bleed" to zero volts in a few seconds, the wise approach is one of complete mistrust.

TEST POINTS

TP1 is the signal line to the input amplifier Z2. This point will have audio signals on it, and the amplitude is controlled by the front panel LEVEL control.

TP2 is the output of the input amplifier Z2. When setting the gain of Z2 by adjustment of the feedback resistor R1, TP2 can be monitored for saturation (limiting).

TP3 is the output of the Multipath Combiner amplifier and permits the proper setting of the Combiner Offset control R221. R221 is factory set for an offset of -0.4 volts. This measurement is made with no signal input and the LEVEL control turned full CCW.

TP4 is the output of the Space slicer following the Space Assessor.

TP5 is the output of the Mark slicer following the Mark Assessor.

TP6 is the output of the third slicer, following the MULTIPATH CORRECTOR™ circuitry.

A fast test of all the logic elements from the front end of the TU thru to the output of the final slicer is:

1) Switch the Mode switch to MS-REV and tune the TU to the Mark-Space tones being generated by the AFSK tone keyer.

2) Check TP1 and TP2 for signal input and output at Z2.

3) Check TP3 for a sine wave (same frequency as RY generator) with an offset of -0.4 volts.

4) Check TP4 and TP5 for square wave slicing (+15 volts). TP5 slices only with the front panel MULTIPATH CORRECTOR switch turned ON. If turned OFF, no slicing takes place (-15 volts).

5) If the MULTIPATH CORRECTOR™ circuit is functioning properly, TP6 will slice symmetrically ±15 volts.

TP7 is the output of the -15 volt regulator.

TP8 is power ground, chassis ground and signal ground.

TP9 is the output of the +15 volt regulator.

TP10 is the output of the AFSK tone keyer (pin 2 of Z43).

TP11 is the output of the RY Generator (pin 6 of Z47).

TP12 is the output of the inverter (Z7) following the Space channel oscillator (Z6).

TP13 is the output of the inverter (Z5) following the Mark channel oscillator (Z4).

TP12 and TP13 may be used to check the frequency of the Mark and Space local oscillators.

A quick check of the Test Points will usually indicate in which section of the TU that a servicing problem exists.

The most common failure is a shorted op-amp.

The best way to find a shorted op-amp is to run the TU for a few minutes and then feel the cases for one that appears to be running hotter than the rest.

If a bad op-amp shorts one of the power supplies, the low voltage regulator on that supply will shut-down without damage.

When the short is cleared, the regulator will cool off and come back up.

If the output of either regulator is above 20 volts as measured at TP7 or TP9, replace the regulator.

The MULTIPATH CORRECTOR™ may be quickly tested by turning it OFF. If the terminal unit continues to function, the MPC is probably functioning properly.

If it is determined that the MULTIPATH CORRECTOR™ is not functioning properly, check Pin 8 of Z31, Z32, Z33 and Z34 with an oscilloscope with a bandwidth of at least 15 MHz.

The output of Pin 8 should be at +15 volts and the high speed scope will show negative going pulses running thru the screen.

A DC or low frequency scope may be used by checking Pin 9 for a square wave, +15 volts to zero volts.

The CRT circuit is straightforward and may be checked as any other vacuum tube circuit. If the cross display fails completely, feel the rear portion of the shield assembly for filament heat. If cold, resolder Pins 1 and 11 on the tube socket with a high heat soldering iron. Sometimes the filament pins of CRTs develop a cold solder joint and the high impedance of such a solder joint shuts off the current in the filament circuit.

If the CRT display blooms, check F3 under the PC board. If F3 is blown, check for leaky filter capacitors (C66 or C67) and shorted power diodes (CR45 and CR46).

The scope input amplifiers (Q10 and Q11) can be checked for excessive heat, indicating a transistor failure or lock-up

due to low Beta.

CAUTION: The cases of Q10 and Q11 are collector circuits and operate at +350 volts.

The TEST PROCEDURE and TROUBLE SHOOTING GUIDE in Section XI should be followed in trouble shooting the MPC-1000(C).

SECTION XII

TEST PROCEDURE AND TROUBLE SHOOTING

The MPC-1000(C) is very easy to trouble shoot, using the built-in RY Generator, AFSK tone generator and the 2 inch cross display CRT as BITE (Built In Test Equipment).

A 15 MHz oscilloscope is preferred (for testing the high speed CMOS circuits) in the MULTIPATH CORRECTOR™ circuit, but a slower speed oscilloscope may be used.

Set up the following test conditions:

Set LEVEL and THRESHOLD controls straight up (SUP). If these controls are changed during a particular test, return them to SUP before going to the next test.

Set the front panel Mode switch to MS-REV (RY Generator).

Set all front panel toggle switches UP.

Adjust the front panel Mark and Space VFOs for maximum deflection of the horizontal and vertical traces on the CRT cross display. The display should be a cross, not a circle or a square, which would indicate both channels are tuned to the same tone frequency. It makes no difference which tone is used for Mark, etc.

All IC op-amps will be measured at the output pin, which is pin 6, except where a test point (TP) has been provided for convenience, or where an op-amp's output can be measured at a rear panel connector.

An accidental shorting of Pin 6 to Pin 7 will destroy the op-amp. For this reason, the op-amps in the filter circuits and precision detectors have small printed circuit tabs protruding from under the IC's socket that are large enough to be contacted with a scope probe.

If the op-amp is shorted accidentally, it will usually split open and smoke, leaving very little doubt about its condition. Recommended replacement μ741 op-amps for the channel filters, precision detectors and low pass filters are the Texas Instrument SN72741P or 741C and the Signetics 741 "commercial" 8-pin minidip. The National LM741CP does not have a high enough slew-rate for locations Z2 thru Z25. If Z2 thru Z25 need replacement, factory-installed op-amps from the other locations should be used, and they can be replaced with lesser op-amps from another source.

Z1 - Not used. In early designs this location was an optional input low pass filter.

Z2 - Input Amplifier. Measure at TP2. ±14 volts or more indicates that this stage is operating properly. Reducing the LEVEL pot setting will reduce the output of this stage. R1 is the feedback resistor and is nominally set a half-scale.

Z3 - Input Inverter. ±14 volts, similar to output of Z2.

Z4, Z5, Z6 and Z7 - Mark and Space local oscillators and inverters. Square wave, switching from zero volts to -15 volts. May be measured at TP12 and TP13, which are the inverter outputs. If the inverters show output, the oscillators are functioning also.

Z8 and Z9 - Mixer Output Buffer Amplifiers. ±15 volts. Mixer products can be seen "within" this signal at the mixing rate.

Q1, Q2, Q3 and Q4 - J-Fet Mixers. These mixers are best measured at the cathode (banded) end of diodes CR1, CR2, CR3 and CR4. This signal will be +15 volts with mixer products at the +10 volt level.

Z10, Z11 and Z12 - Mark Channel Filters. The output of each of these stages is a symmetrical pulse representing the pulse sent by the RY generator. Amplitudes will vary between ±12 and ±8 volts.
Measure at PC tab protruding from under socket, directly below Pin 6.

Z18, Z19 and Z20 - Space Channel Filters. Same as Mark channel filters above. A comparison of the Mark and Space filters complimentary sections will indicate whether the op-amp is working properly.

Z13 and Z21 - Filter Output Buffer Amplifiers. ±15 volt pulses. May be flat-topped by limiting in these stages, but this is not important. Output level of the two buffers should be similar in appearance and within 1 DB of each other

Z14, Z15 Z22 and Z23 - Precision Detectors.

Z14: +13 volts, half wave pulses.
Z15: -7 volts, half wave pulses.
Z22: -13 volts, half wave pulses.
Z23: +7 volts, half wave pulses.

Z16 and Z17 - Space Low Pass Filter. Sine Wave, zero to -4 volts.

Z24 and Z25 - Mark Low Pass Filter. Sine Wave, Zero to +4 volts.

Z26 - Multipath Combiner Amplifier. Measure output at TP3. With LEVEL control at SUP, 9 volts peak to peak (+4 volts to -6 volts). Turn Level control to full CCW (zero signal input). Output at TP3 should be -0.4 volts. This -0.4 volt level may be adjusted with the Combiner Offset adjustment at R221.

Z27 - Space Buffer Amplifier. Read at junction of C36 and C37. 12 volts, peak to peak, sine wave, with a DC offset of +3 volts.

Z29 - Mark Buffer Amplifier. Read at junction of C38 and C39. 12 volts, peak to peak, sine wave, with a DC offset of -3 volts.

Z28 - Space Slicer. ±15 volts square wave at TP4.

Z30 - Mark Slicer. ±15 volts square wave at TP5 with the MULTIPATH CORRECTOR™ switch on front panel in UP position (ON). Zero volts with the MULTIPATH CORRECTOR™ switch in the OFF position. Return the MPC switch to the ON position (UP).

Z31, Z32, Z33 and Z34 - MULTIPATH CORRECTOR™ CIRCUIT. With front panel MPC switch turned ON (UP) and with a 15 MHz or faster test oscilloscope, read signal at Pin 8. This signal is also available at the cathode end (banded) of diodes CR23, CR24, CR25 and CR26. This signal should be setting high (+15 volts) with a series of negative going pulses (spikes) descending to zero volts. Lesser spikes (staying over 8 volts) are of no consequence.

If the test oscilloscope is not fast enough to display these spikes, check for a square wave signal at Pin 9 of each chip, which should be switching between +15 volts and Zero volts.

A square wave signal at Pin 8 indicates a faulty chip.

Turn the front panel MPC switch to OFF (Down).

Z31 and Z32 (CR23 and CR24) should test as above.

Z33: Pin 8, +15 volts, and Pin 9, zero volts.

Z34: Pin 8, +15 volts, and Pin 9, +15 volts.

Return front panel MPC switch to ON (UP).

This test verifies all 16 gates of the MPC. A "slow chip will not display the high speed negative-going pulses and should be replaced. Test oscilloscopes with less than 15 MHz of bandwidth probably will not register these pulses at all.

Z38 and Z48 - Mark and Space Channel LED Drivers.

If the front panel Mark and Space LEDs are flashing, the op-amp drivers are okay.

Pin 6 of either op-amp will display a pulse similar to a channel filter pulse with one side clipped at 3.5 volts, due to the clipping action of the LED diode. This is an AC circuit and the polarity of the LED is not important. Replacement LEDs may be installed with either polarity.

Z37 - Signal Loss Circuit. The output of this circuit may be checked at the rear panel SIGNAL LOSS connector (J11). The output is nominally -10 vdc and shifts to +10 vdc when the front panel LED indicates that the signal has been lost.

Improper operation of this circuit often indicates a problem in a preceding stage: Z26, Z36, Z38 or Z39.

If the Signal Loss circuit is operating properly it will respond in the following manner:

1) LEVEL control SUP and Standby switch ON = Signal Loss LED OFF*.
2) LEVEL control SUP and Standby switch OFF = Signal Loss LED ON*.
3) LEVEL control CCW and Standby switch ON = Signal Loss LED ON*.

*If the MPC-1000(C) has a bipolar red/green LED installed in this position, OFF will indicate green and ON will indicate red.

Z38 - Common Mode Amplifier. With LEVEL control SUP: ±14 volts square wave, but not necessarily symmetrical. As THRESHOLD control is turned CCW, square wave should become symmetrical. With LEVEL control CCW (no signal): -14 volts.

Z39 - Automatic Mark/Hold, Anti-Space, Anti-CW and Anti-Mark/Fade (AMF).
This stage functions as a pulse width discriminator.
With Level control SUP: -15 volts.
With Level control CCW: +15 volts.

Z40 - Not used. In early designs, Z38 functioned as a DC coupled DTC and Z40 was required for some of the functions that are now performed by Z39.

Z41 - Autostart Driver Circuit, FSK mode.
With Level control SUP: +15 volts.
With Level control CCW: -15 volts.

Z42 - Autostart Relay Circuit Driver. This circuit should be checked in both FSK and MARK autostart modes.

Mark: Level control SUP: +15 volts. Level Control CCW: -15 volts.

FSK: With the mode switch in the MS-REV position, Pin 6 of Z42 will switch to +15 volts regardless of setting of the level control, due to coupling of Z45 thru CR34 to Z42.

Z43 - AFSK Tone Generator. Output of Pin 2 may be measured at TP10 and will be between 2 and 3 volts peak to peak with a positive DC offset between 2 and 8 volts. The keying voltage at Pin 9 should be a square wave from zero volts (less than 0.5 volts) to greater than 3 volts.

Z44 - Not used. In early designs this location contained an AFSK output buffer, which was susceptible to keying transients from the high level loop, and which has been replaced with C85, R148 and R149.

Z45 - EIA RS232C FSK Voltage Level Output. In the MS-REV mode: ±15 volts square wave. In MS mode: -15 volts (Marking. This measurement may be made at the rear panel connector EIA J6.

Z46 - MIL STD 188C FSK Voltage Level Output. In the MS-REV Mode: ±6 volts square wave. In the MS mode, +6 volts (Marking). This measurement may be made at the rear panel connector MIL J8.

Z47 - RY Generator (MS-REV). The output of Z47 may be measured at TP11. In the MS-REV mode: ±15 volts square wave. In MS mode: Zero volts.

Q5 - Autostart Relay Keyer. Measure from collector (case) to ground. With Level control SUP, +20 volts unregulated (relay de-energized), and zero volts (relay energized).

Q6 - Loop Driver. Measure at REGEN OUT (J13) at rear panel. Level control SUP: Square wave, +13 volts to zero. LEVEL control at CCW: +13 volts.

Q7 - High Level Keyer. Measure Collector (case) to ground. Danger. High voltage (+130 volts). LEVEL control at SUP: Square wave, +250 volts to zero. LEVEL control at CCW: Zero volts. Flashing of the loop LED indicator indicates that the loop circuit is being keyed by Q7.

Q8 - Regulated +15 volts. Measure at TP9.

Q8 - Regulated -15 volts. Measure at TP7.

Q10 and Q11 - CRT Scope Channel Amplifiers. Measure at Collector (case). LEVEL Control at SUP: Channel filter type pulses of ±50 volts with a +125 volt offset. With level control at CCW: +125 volts.

Q12 - CRT Dot Deflection Circuit. Measure at Collector (case) to ground. With LEVEL Control at SUP and Dot at center of CRT screen: Zero volts. With LEVEL Control at CCW and dot deflected to bottom of CRT screen: +200 volts.

If the dot does not deflect all the way to the bottom of the screen, the transistor at Q12 should be replaced.

To prevent dot deflection, maintaining the dot at all times in the center of the CRT screen, remove Q12 and jumper the collector to emitter socket pins.

DS1 - Loop Monitor LED Indicator. Measure green lead that comes from E35. With LEVEL at SUP: Square wave, zero to -2.0 volts. With LEVEL control at CCW: -2.0 volts.

DS2, DS3 and DS4 were checked previously with their associated circuits. Polarity of DS2 and DS3 is not important, since they are being driven by AC circuits. DS1 and DS4 are polarized with their longest lead toward the left side of the terminal unit. DS4 may be installed backwards and then will light on acquisition of a signal (AOS) instead of upon loss of signal (LOS). If a bipolar red/green LED is installed at DS4, it will be green with AOS and red with LOS. DS1 will not function if installed backwards.

Q13 - Automatic Threshold Level (ATL) circuitry. Q13 and R216 are located under the forward portion of the CRT.

With the LEVEL and THRESHOLD controls set for SUP and the mode switch in the MS-REV position, measure the drain (D) of Q13, which is the center lead of the device. The drain may also be measured at that end of R216 that is closest to the centerline of the terminal unit.

This voltage level should be -0.04 volts. Set the Level control to CCW (no signal condition) and the drain voltage level should shift to -0.18 to -0.20 volts.

SECTION XIII

TROUBLE SHOOTING HINTS

Experience has shown that 99% of all failures in the first 1000 hours of operation are due to infant mortality of the semiconductors.

For this reason, all semiconductors are mounted in low profile sockets.

Since Z46, MIL STD 188C FSK output generator, is very seldom used, it can be considered as a "spare", if needed. It can be replaced by any manufacturer's µ741.

Likewise the transistor in the Dot Deflection Circuit (Q12) may be used as a spare for any of the five transistor locations. If used, add a jumper between the collector and emitter pins in Q12's socket, which will maintain the CRT's dot in the center of the screen.

All signal diodes (except the four 1N270s in CR44) may be replaced with any high speed silicon diode.

All power diodes should be replaced with a 1N4007 or equivalent.

If the terminal unit performs well in the MULTIPATH CORRECTOR™ "ON" mode, but locks up with the MPC turned off, check the CMOS chips, Z31 thru Z34. If they check good, suspect Z27 and Z28.

If either the Mark or Space channel LED indicators stop flickering, although the TU appears to copy normally, do not assume the trouble is in the LED driver circuit or with the LED diode itself.

It is more probably an op-amp failure in one of the channel filters or one of its input or output buffer amplifiers.

The high performance of the MPC-1000(C) as a single channel In-Band Diversity TU automatically covers up the loss of one channel, but error rates will increase when the one working channel takes deep fades.

If the CRT Cross Display indicates a channel, but that channel's LED does not flicker, suspect one of the output buffers, Z13/Z21.

If both CRT and LED indicator for one channel cease to function, suspect the input buffers (Z8 or Z9) and the op-amps in the that particular channel filter.

A simultaneous loss of gain in both channels indicates a probable failure in the input inverter stage, Z3. Loss of gain only one channel (half power) is probably a bad op-amp at Z5 or Z7, or a failed J-Fet at Q1 thru Q4.

SECTION XIV

SPARE PARTS INFORMATION

There are no special or hard-to-get components used in the Dovetron MPC-1000(C) Terminal Units. A few items are proprietary to Dovetron and are available on a postpaid (USA) basis and will be shipped via UPS. COD orders will not be accepted for these items:

Power transformer: WDI-7827B.	$20.00
Front panel: Specify Amateur/Comm.	$30.00
CRT bezel: Painted, flat black.	$15.00
Side plate: Rackmount or tabletop.	$10.00/set.
Audio transformer: 600Ω input.	$6.00
IC Op-amp: μ741C, minidip, plastic.	$0.75 each.

All operational amplifiers are tested for slew rate, low offset voltage and low input bias current.

The Texas Instrument and Signetics devices are preferred, because of their slew rate, which is required in the channel filters, precision detectors and low pass filters.

As other manufacturer's op-amps become suitable they may be used.

All standard components (except the PC board) may be ordered from Dovetron, although they are probably available from local, domestic sources. Where pricing is not published, these items may be ordered COD.

The Plessey capacitors may be replaced by dipped silver-micas, type CMO6 and DM20.

Spare CRTs are available only to the original purchasers of the MPC-1000 and MPC-1000C at $25.00 each postpaid.

CRTs are not returnable from credit. Each CRT is checked before shipment for proper performance and insured with the shipping carrier for full value.

A $5.00 deposit is required with all COD orders, and minimum billing charges are $5.00.

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION XV

RECOMMENDED SPARES AND PROVISIONING

The following items and quantities are based on 24 hours continuous duty operation in environments of 0°C to 50°C and 90% Relative Humidity without condensation, and will support five Dovetron MPC-1000C Terminal Units for 12 months.

2 each	Potentiometer, A&B, JA1N056S202UA, 2.0KΩ, 10% tol.
1 each	Potentiometer, A&B, Type J-Locking, 5.0KΩ, 10% tol.
2 each	Capacitor, Sangamo, 066HJ400T350B, 40 Mfd, 350 VDC.
1 each	Capacitor, Sangamo, 066HL400T450B, 40 Mfd, 450 VDC.
2 each	Capacitor, Rubycon, Type TW, 1000 Mfd, 25/35 VDC.
4 each	Diode, germanium, TI, 1N270.
4 each	Diode, silicon, TI, 1N914, 1N4148 or equiv.
5 each	Diode, power silicon, TI, 1N4005.
5 each	Diode, power silicon, TI, 1N4007.
4 each	Transistor, high voltage, NPN, TI, 2N3439.
2 each	Transistor, low voltage, NPB, TI, 2N697.
2 each	Regulator, voltage. Motorola, MC7815CP, +15 volts.
2 each	Regulator, voltage. Motorola, MC7915 CP, -15 volts.
4 each	Integrated circuit, CMOS, Motorola, MC14011AL.
2 each	Integrated circuit, EXAR, XR2206C.
4 each	Transistor, N-channel, J-Fet. Teledyne, U-1897E.
9 each	Operational amplifier, TI, SN72741P, 8-pin, minidip.
4 each	Diode, light emitting, Red. OPCOA, high dome, diffused.
1 each	Resistor, power, Ohmite 0206, 1500Ω, 25 watt, fixed.
1 each	Resistor, power, Centralab WN-102, 1KΩ, 5W, variable.
1 each	Switch, rotary, Centralab, PA-1021, 6 pole, 5 Pos, NS.
2 each	Jack, panel mount, Switchcraft 3501FP.
2 each	Jack, Nylon, Switchcraft, N114B.
2 each	Switch, toggle, miniature, ALCO, SPDT, MTA-106D.
1 each	Switch, toggle, miniature, ALCO, SPDT-CO, MTA-106E.
1 each	Switch, toggle, miniature, ALCO, DPDT, MTA-206N.
1 each	Relay, DPDT, Potter Brumfield, KA-3704 or KA11DG.
1 each	Transformer, Power. Wood Transformers, Inc. WDI-7827B.
1 each	Transformer, Audio. Triad/Utrad, TY-34X.
1 each	Tube, electron, CRT. RCA, Type JAN-2AP1A.

For 25 units, multiply all items by 3. For 50 units, multiply by 4. For 100 units, multiply by 5.

The above items and respective quantities are based on field experience and assume that the Terminal Units will be serviced at a central location.

A spares kit is available from Dovetron that will support two MPC-1000C separately for 12 months. Consult factory for price and delivery.

SECTION XVI

PARTS LIST - E SERIES

DESIGNATION	COMPONENT
C17, C32.	390 Pfd, 5%, Silver Mica, CMO5FD.
C19, C34.	2000 Pfd, 5%, Silver Mica, CMO6FD.
C20, C35.	2400 Pfd, 5%, Silver Mica, CMO6FD.
C6, 7, 8, 9, 10, 11, 15, 16, 18, 21, 22, 23, 24, 25, 26, 30, 31, 33.	4700 Pfd, 5%, Mylar, Plessey 4N7J630, or Silver Mica, CMO6FD.
C40, 41, 42, 43.	0.001 Mfd, 20%, disc.
C44, 63, 64, 76, 79.	0.01 Mfd, 20%, disc.
C61, 62.	0.01 Mfd, 20%, 1KV, disc.
C4, C5. (MPC-1000)	0.047 Mfd, 5%, Mylar, Plessey .047J250.
C4, C5. (MPC-1000C)	0.056 Mfd, 5%, Mylar, Plessey .056J250.
C3, 12, 27, 52, 53.	0.1 Mfd, 5%, Mylar, Plessey 0.1J250.
C45, 46, 47, 48, 55.	1.0 Mfd, 5%, Mylar, Plessey 1J100.
C36, 37, 38, 39.	10 Mfd, 35 VDC, 10% tantalum dip.
C54, 83, 84.	1 Mfd, 20 VDC, 20% electrolytic.
C49, 51.	10 Mfd, 35 VDC, 20% electrolytic.
C60, 66.	40 Mfd, 350 VDC, electrolytic.
C67.	40 Mfd, 450 VDC, electrolytic.
C56, 57.	1000 Mfd, 25/35 VDC, electrolytic.
C1, C2, C13, C14, C28, C29, C68, C69, C70, C71, C72, C73, C74, C75, C58, C59.	These capacitor locations are not used in the MPC-1000(C) E-Series.
CR1 - CR36, CR38 - CR41, CR50, 51, 52, 53, 54, 55, 58.	Diode, silicon, signal, high-speed, Types 1N914, 1N3600, 1N4148, or equiv.
CR37, 42, 43, 45, 60, 61.	Diode, silicon, power, 1N4005.
CR46, 47, 48.	Diode, silicon, power, 1N4007.

DESIGNATION	COMPONENT
CR44.	Diode bridge, consists of four 1N270 Germanium signal diodes.
F1. (110 VAC mains)	Fuse, 3AG. 0.5 amp, slow-blow, 110 VAC.
F1. (220 VAC mains)	Fuse, 3AG. 0.25 amp, slow-blow, 220 VAC.
F2.	Fuse, 3AG. 0.1 amp, fast-blow.
F3.	Fuse, 3AG. 1/32 amp, slow-blow.
J1. (MPC-1000)	Jack, panel mount, Switchcraft 3501FP.
J1A. (MPC-1000C)	Jack, Nylon, audio type, Switchcraft N114B.
J2 thru J17.	Same as J1.
J18, J19.	Sames as J1A.
K1.	Relay, DPDT, 24 VDC, 10 amp contacts. Potter Brumfield KA3704, KA11DG or equiv.
DS1, DS2, DS3, DS4.	Indicator, LED, red, high dome, diffused.
P1.	Connector, power. Switchcraft, AC3G.
P2.	Connector, printer. Waber 3018B.
Q1, Q2, Q3, Q4.	Transistor, J-FET, N-channel. U-1897E.
Q5, Q6.	Transistor, NPN, medium power, 2N697.
Q7, Q10, Q11, Q12.	Transistor, NPN, high voltage, 2N3439.
Q13.	Transistor, J-FET, P-channel, 2N4360.
Q8.	Regulator, +15 volts, 1 amp. MC7815CP.
Q9.	Regulator, -15 volts, 1 amp. MC7915CP.

ALL RESISTORS: 5%, 1/4 WATT, CARBON FILM, UNLESS NOTED.

R167.	15Ω
R170.	33Ω
R87, 96, 108, 109.	120Ω
R151.	200Ω
R114, 149, 150, 158, 159, 160, 196, 219.	470Ω
R187, 199A, 199B, 200, 204, 216.	1000Ω
R168.	1500Ω, 25 watt, vitreous (standard).
R168A, R168B.	3000Ω, 25 watt, vitreous (optional).

DESIGNATION	COMPONENT
R132, 133, 197, 211, 212.	2000Ω
R143, R146.	2000Ω, 1%, metal film.
R31, R56.	2.61KΩ, 1%, metal film.
R28, 53.	2.87KΩ, 1%, metal film.
R43, 68, 84, 98,134, 177.	4700Ω
R25, R50.	3.48KΩ, 1%, metal film.
R77.	12.4K, 1% metal film.
R2-R11, R13-R16, R18, R20,	10KΩ
R21, R38-R42, R63-R69, R74,	10KΩ
R76-R82, R86, R90, R91, R95,	10KΩ
R99-R107, R110, R115, R116,	10KΩ
R122, R123, R129, R142, R144,	10KΩ
R154-R157, R162, R164, R166,	10KΩ
R175, R181, R183, R189, R217.	10KΩ.
R161.	11KΩ.
R23, 52, 83, 85, 92, 94,	20KΩ
117, 127, 128, 148.	20KΩ
R113, 118, 140, 144.	30KΩ
R34, 59.	62KΩ
R35, 36, 37, 60, 61, 62, 88,	100KΩ
97, 111, 112, 130, 137, 138,	100KΩ
157, 165, 182, 202.	100KΩ
R119.	180KΩ (May be as high as 270KΩ).
R30, R55.	237KΩ, 1%, metal film.
R24, 49, 52.	301KΩ, 1%, metal film.
R178.	390KΩ
R27, R52.	402KΩ, 1%, metal film.
R121, 136, 149, 153, 176.	470KΩ
R26, R51.	604KΩ, 1%, metal film.
R29, 54.	806KΩ, 1%, metal film.
R32, 57.	715KΩ, 1%, metal film.
R214, 215.	1.0 megohm
R186.	3.0 megohm

DESIGNATION	COMPONENT
R172A.	Not factory installed.
R33, 58, 124, 125, 126, 135, 185, 202, 203.	Not used in E-Series.
R145A, R147A, R172, R205.	2KΩ Pot, 10% tol. JA1N056S202UA.
R145B, R147B.	5KΩ, PC type, Piher PT15YB.
R206, R207.	5KΩ, pot, 10% tol. locking-type.
R163.	10KΩ, pot, PC, Piher, PT15YB.
R195.	100KΩ, pot, PC, Piher, PT15YB.
R173, R180.	250KΩ, pot, PC, Piher, PT15YB.
R1, R221.	500KΩ, pot, PC, Piher, PT15YB.
R191, 192, 193, 194.	500KΩ, pot, PC, CTS XR201R504B.
S1.	Switch, rotary, 6 pole, 5 position, non-shorting, Centralab PA-1021, or OAK Industries P/N: 527432113.
S2, S3, S5.	Switch, toggle, miniature, SPDT, ALCO MTA-106D, or equiv.
S4, S7.	Switch, toggle, miniature, DPDT, ALCO MTA-206N, or equiv.
S6.	Switch, toggle, miniature, SPDT/CO, ALCO MTA-106E, or equiv.
T1.	Transformer, power. Wood Transformer, Inc., 810 Lemon Street, Calif., 92667. P/N: 7827B. Pri: 110/220 VAC, 50-400 Hz, 1 Ø. Sec: 1) 36 VAC, 1 amp, CT. 2) 130 VAC, 100 Ma. 3) 350 VAC, 50 Ma. CT. 4) 6.3 VAC, 1 amp.
T2.	Transformer, audio input, 600Ω. Triad/Utrad TY-34X.
V1.	Tube, electron, CRT. RCA-JAN2AP1A.
Power Cord.	Belden 17258-S, three wire.
Z2-Z30, Z35-Z39, Z41, Z42, Z44, Z45, Z46, Z47.	Integrated circuit, linear, μ741C. 8-pin, minidip, plastic. TI-SN72741I or equivalent.

DESIGNATION	COMPONENT
Z31, Z32, Z33, Z34.	Integrated circuit, digital, CMOS, MC14011AL or CD4011AE, ceramic.
Z43.	Integrated circuit, monolithic, Exar Corp., type XR2206C.
PC-1	Photocell, Vactec VT-343.
R77.	12.4KΩ, 1%, metal film.
R169.	1KΩ pot, 5 watt, Centralab WN102.
Chrome Handle.	Amitom 10205B0632.
CRT Bezel.	A. L. Johnson, Monrovia, Cal. P/N 383, Revision C.
Knob, Small.	Kurz-Kasch S-1647-1L.
Knob, Large.	Kurz-Kasch S-1653-1L.
CRT socket.	Alden Products 211FSC (2AP1A).
CRT shield.	Millen Mfg. Co., 80802-126.
F1, F2 fuseholder.	Littlefuse 342004A.
F3 fuse clip.	Bussman 1A1119-10.
Socket (PC-1)	H. H. Smith 6265.
Socket (Transistors)	Cinch Jones 3LPS-B.
Socket (8 pin IC)	Texas Inst., C830802.
Socket (14 pin IC)	Texas Inst., C831402.
Socket (16 pin IC)	Texas Inst., C831602.
Feet (cabinet)	3M Products, SJ5023.
Cabinet assembly	Intrafab, San Jose, Cal. MCLS-3179.
Side plate, table top.	Intrafab, SPH-39.
Side plate, rack mount.	Intrafab, SPHR-39.
Printed Circuit Board	Dovetron A75100E.
Support Bars (PC board)	Dovetron CS-1.

SECTION XVII

WARRANTY

DOVETRON warrants all parts, labor and quality of construction for twelve (12) months from the date of shipment, except no warranty is extended to the Cathode Ray Tube.

During this 12 month warranty period, a defective MPC-1000(C) will be repaired or replaced at DOVETRON's discretion, at no charge.

All Terminal Units returned for warranty service must have shipping charges prepaid.

No units will be accepted on a freight-collect basis.

For fast, prompt warranty service, please notify DOVETRON prior to shipment, that unit is being returned for warranty service.

State clearly all suspected or confirmed problems.

Enclose a statement of problems with the instrument.

Provide a return address in original correspondence and with the returned instrument.

Upon completion of warranty repair, normally within 24 hours, the terminal unit will be returned to sender Freight-Collect. This shipping charge may be prepaid: $7.50 Continental USA.

NON-WARRANTY REPAIRS

Terminal Units returned for non-warranty repairs will be billed for parts and labor. The labor rate is $18.00 an hour. Normal wear and tear (scratched panels, lids, etc.) will not be repaired or replaced unless specifically requested.

WARRANTY WAIVERS AND EXCEPTIONS

The user is encouraged to repair his terminal unit and will not invalidate the 12 month warranty, if due caution and respect is used. Soldering irons with power ratings in excess of 20 watts should not be used on the PC board.

Defective parts returned to DOVETRON during the warranty period will be promptly replaced. Spare parts orders are normally filled and shipped the same day as received.

WARRANTY, PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION XVIII

NOTES

REGENERATION

When in the Transmit mode with a peripheral Regenerator/Speed Converter, the high level keyer (Q7) must be locked into the Mark condition.

This is easily done by supplying a constant +5 to +15 volts to the REGEN IN port (J12) from the peripheral via the cable interconnecting J12 to the peripheral, during TRANSMIT.

This may also be accomplished if the peripheral automatically reconnects J12 and J13 when in the Transmit mode, permitting the Automatic Mark Hold circuit within the terminal unit to lock the high level keyer into Mark.

A remote contact closure ground to E65 also locks the high level keyer into Mark. The contacts must be capable of handling 60 Ma. at 130 VDC.

SIGNAL LOSS LED

The Signal Loss LED on the front panel will flicker when the terminal unit is switched to Standby and has an input signal present. Even if the signal is too weak to light the Mark and Space LEDs, the Signal Loss LED will indicate that the terminal unit is processing a signal, but the Standby switch is inhibiting the high level keyer circuits.

ADDITIONAL EIA RS-232C FSK OUTPUT

If the EIA FSK output at J6 is dedicated to driving a teleprinter, regenerator, etc., and an additional EIA FSK line is required, the MIL STD 188C FSK output at J8 may be converted to EIA characteristics by removing Z46 from its socket. The output impedance of this second EIA line will be 31K ohms, the sum of R155, R156, R157 and R158. This impedance may be lowered by modifying the values of R155-R158 accordingly.

AUTOSTART "IMMEDIATE" TIME-OUT

Sometimes (particularly during servicing) it is convenient to manually force the autostart to zero and de-energize the time-out relay. This can be accomplished by momentarily turning the main power switch Off and then right back On. The negative bias on the time constant circuits will reset them to zero and de-energize the autostart relay.

DOVETRON

BBP-100 FIELD RETROFIT INSTALLATION

The addition of the BBP-100 Binary Bit Processor to a Dovetron MPC Series Terminal Unit provides Selectable Bandwidth, superb Axis-Restoration and hysterisis Multipath Correction. These features provide a level of performance unknown in a commercial terminal unit and care should be taken during the installation not to damage the other components of the terminal unit.

The following instructions pertain specifically to E-Series terminal units, which are identified on the bottom of the mainboard with the part number A75100-E. All MPC-1000R units are E-Series.

Before proceeding with the modification of the mainboard, compare the 8 pin sockets on the mainboard with the side-wipe type 8 pin socket used on the BBP-100 board.

If the mainboard uses the same socket, complete the modification. If the mainboard contains a "low-profile" socket, notify Dovetron and a set of six high profile sockets will be made available.

Although the modification may be accomplished with the headers plugging into low-profile sockets, the low-profile socket will not guarantee a satisfactory interface over a long period of time.

To remove a low profile socket from the mainboard, pull it off. Then remove the individual pins and clean out the holes with solder wick. Do not use a solder sucker, since these gadgets have a tendency to spray the mainboard with little balls of solder than can cause unbelieveable problems.

MAIN BOARD MODIFICATION

If the DAS-100 Digital Autostart module is installed in the TSR-500(D) assembly, remove it completely and protect the pins of the header from accidental damage.

If equipped with a TSR-500(D) assembly, remove it by removing the nuts at three locations and the four plug-in cables. Note that the bevelled corner of the cable plugs face toward the left-front of the terminal unit. This bevel indicates pin 1 in the cable. Damage to the TSR-500(D) assembly will result if these cables are re-installed backwards.

If equipped with a wired-in TID-100 Station Identifier board, remove the two wires in the left-front corner so the board may be folded back over the rear panel of the terminal unit.

If a KOS-100 assembly is installed in the terminal unit, the TID-100 may be unplugged and removed, and the KOS-100 will be folded back over the rear panel to permit access to the main board of the terminal unit.

To prepare the main board of the terminal unit for the BBP-100:

1) Remove the op-amps (10) at locations Z16, Z17, Z24, Z25, Z26, Z27, Z28, Z29, Z30 and Z36. Save these 741s for use as spares.

2) Remove the four integrated circuits at locations Z31, Z32, Z33 and Z34. Save these 14011/4011s for use as spares.

3) Locate and remove the following capacitors: C15, C16, C17, C18, C19, C20, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43 and C44.

The large white caps and the dipped mica caps should be unsoldered. Take care not to damage the plated-thru holes as the caps are removed. These plated-thru holes form part of the terminal unit's continuity of circuitry. If you suspect a damaged hole, i.e., no continuity from one side of the board to the other, insert a small wire in the hole and solder both sides of the board.

The small dipped tantalums and ceramic disc capacitors may be snipped out in the interest in time. These items are being removed only because they will mechanically interfere with the BBP-100 assembly.

4) Remove resistors R45, R46, R70, R71, R75 and R79. Replace each with a jumper wire.

5) Remove the potentiometer at R221. (Discard.)

6) Remove the resistors at R74, R76, R77, R80 and R81. These may be snipped out.

INSTALLATION OF BBP-100 BOARD

1) Install an 8 pin header in each of the main board sockets Z16, Z24, Z26, Z27, Z29 and Z36. The long pins go into the sockets and the short pins (blades) will stick up thru the BBP-100 board. The pin location bevel is not important.

2) Before putting the BBP-100 down on top of the 8 pin headers, install one of the 3/8 inch spacers on the long bolt that will pass thru the hole at the front edge of the BBP-100.

A nylon flat washer has been provided, but may not be needed to level the BBP-100.

3) Slip the BBP-100 onto the long bolt and carefully orient the BBP-100 board onto the six 8 pin headers.

There are two areas of possible interference:

If the orange wire running to the terminal strip next to the audio input transformer is too short, it may interfere. If it does, replace it with a longer wire.

There are two types of 741 op-amps used in the Dovetron terminal units. One has a higher profile than the other. The 741s on the BBP-100 are the low profile type. If high profile types are mounted

on the main board at locations Z14, Z15, Z22, Z23, Z2 and Z38, they may prevent the BBP-100 from laying down flat on the 8 pin headers. Although that will not impair performance in any way, it is a good idea to interchange the high profile 741s on the main board in these locations with six of the low profile 471s supplied on the BBP-100 board. Be sure to orient the ICs properly in their sockets. If in doubt, don't change them.

4) With the BBP-100 resting flat on the headers, carefully solder the top blades of each header to the BBP-100 board. If either of the boards appear to have some warp to it, push down on the BBP-100 while soldering to assure that the blade of the header comes thru its hole on the BBP-100.

Although it is not necessary to remove any flux residue from the header section of the BBP-100, the board may be cleaned with alcohol or shellac thinner (denatured alcohol).

The BBP-100 may be removed for clean up. If for any reason, a header pin becomes damaged, consult print 75192 and the board. You will note that not all the pins are used electrically. A non-active pin may be removed from the header and re-inserted in place of a damaged active pin. Pin removal is accomplished by heating the top short end of the pin and pushing the pin up thru the board while the solder and plastic are hot. Excess solder can be wicked out. Solder suckers should not be used, since they have a tendency to spray the board with small balls of solder, which can cause unbelievable problems.

With the BBP-100 installed, the terminal unit may be reassembled. Using the hardware originally supplied with the terminal unit and those additional items supplied with the retrofit kit, reinstall the original accessories.

As now configured the MPC switch on the front panel offers two bandwidths: WIDE and NARROW. As shipped from Dovetron, this will provide bandwidths of 45.45 Baud and 74.2/75 Baud, which corresponds to 60 and 100 WPM Baudot operation.

The Wide position is MPC (UP) and the Narrow position is OFF (DOWN).

MEDIUM BANDWIDTH SELECTION

The BBP-100 Binary Bit Processor has been designed in such a way that when neither Wide nor Narrow positions are selected, the BBP-100 automatically sets itself to the Medium bandwidth position.

This permits selection of the Medium bandwidth by replacing the front panel SPDT (MPC ON-OFF) with a three position switch with a Center-OFF position.

To install a SPDT-CO switch, clip the existing wires at the switch.

You may be able to remove the switch without removing the front panel,

since the front panel is counter-bored from the rear and will capture the front nut when the switch is removed.

If it is necessary to remove the front panel to replace the switch, remove all the front panel knobs, the cross display's bezel and the chrome handles.

After the new switch is installed, replace the accessory boards. Consult the prints for a recommended stacking arrangement, using the various spacers supplied.

SELECTION OF BANDWIDTH MODULES

As supplied by Dovetron, the Wide position contains a 74.2/75 Baud bandwidth module, the Medium position contains a 50 Baud module and the Narrow position contains a 45.45 Baud module.

Two additional modules are stored in Storage sockets A and B at the left rear of the BBP-100 board and may be interchanged with the three active modules.

The bandwidth of each module is determined by the value of the resistors installed in the module itself. Consult the prints for the relationship between resistance value and bandwidth (Baud rate).

If 110 Baud operation is anticipated, a good combination for the active modules would be 110 Baud, 74.2/75 Baud and 50 Baud.

The difference between 45 and 50 Baud bandwidths is normally not apparent. In fact, it turns out that a slightly wider than optimum bandwidth is often helpful on poor quality signals.

TROUBLE SHOOTING AND TESTING

The best way to test the BBP-100 is to switch the terminal unit to MS-REVERSALS and tune the Mark and Space channels for a normal cross display.

Signal input to the BBP-100 is on Pin 3 of the Z16 and Z24 headers and is the output of the Precision Detectors on the mainboard at Pin 6 of Z15 and Z23 respectively.

Pin 6 of U52 on the BBP-100 board is the sum of the two input signals.

From this point, the signal is processed thru the two section low pass filter.

The output of the low pass filter is at TP15 on the BBP-100 board.

If the signal is present at TP15, switch the front panel Bandwidth switch thru its positions and notice the change that occurs in the low pass filter output. If one bandwidth does not appear to be working, check the bandwidth module for that position. Look for a solder bridge between two adjacent resistors and/or a poor solder connection.

If it is necessary to resolder one of the resistors in the bandwidth module, it is best done with the module plugged into a socket or a piece of plastic foam to prevent any movement of the pin's alignment as the plastic header is heated up.

If it is determined that the module is okay, suspect the 14066 bilateral switch at U54, U55 or U56. These integrated circuits have a record of very excellent performance and it is more likely that you will find a folded under pin or a damaged pin in the socket.

TP16 and TP17 are both FSK outputs, and are inverted from each other. The output of TP17 is not used by a standard MPC terminal unit, which means that the 741 op-amp in location U71 may be used as a spare.

TP16 should have a square wave output. If not, check Test Points A, B, C and D that are directly in front of capacitors C107, C108, C109 and C110. A and B will have similar information on them, and C and D should be similar, but inverted from A and B.

If the problem appears to be in this area, check U59 for output at Pin 6, the two 14066 and U60 and U61 and the I.C.s in the Track and Hold Logic Section.

If a TL081CP op-amp is found to be not functioning, it may be replaced temporarily with one of the spare 741s. For maximum performance, the TL081CP is preferred in locations U57, U58, U59, U62 and U64. The latter two circuits are impedance buffers and 741s work well here, so keep TL081CP type units in the three former locations.

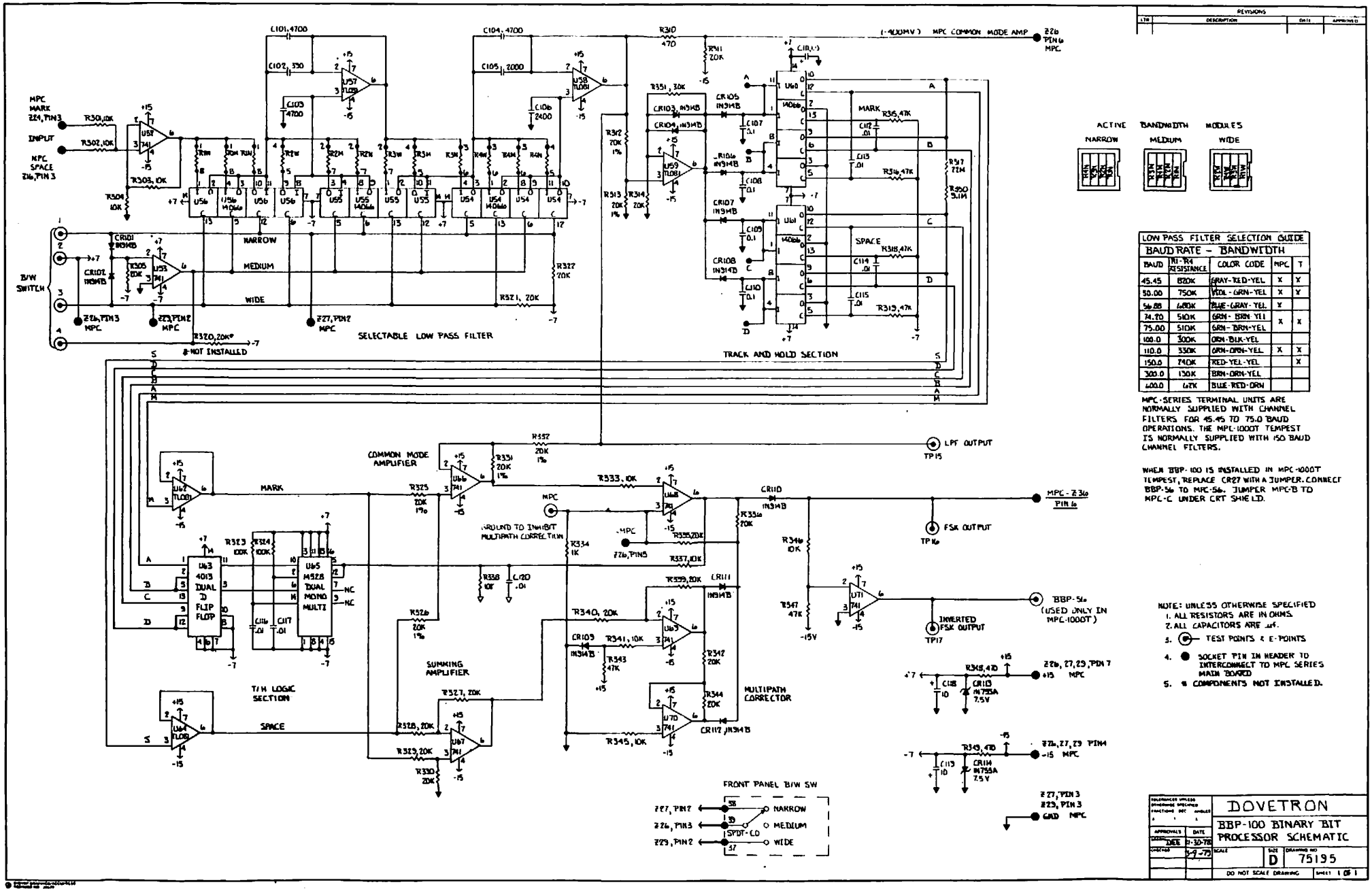
If the BBP-100 appears to be working properly, check Pin 6 of header Z26 for a negative 400 millivolt level with no signal input. A significantly different level at this point would indicate a problem in the low pass filter and U57 and U58 would be suspect.

THEORY OF OPERATION

A deep explanation of the theory of operation of the BBP-100 will not be attempted. It is a complicated, proprietary circuit and is in the process of being commercially protected.

Basically, the BBP-100 processes the incoming data thru a selectable bandwidth low pass filter section which strips the carrier information from the data. The data in Mark and Space form is then "tracked" in the Track and Hold Section, and the energy level of the sequential Mark and Space conditions are compared to establish the proper axis restoration point. The T/H Logic Section controls the Track and Hold Section and takes its information from the incoming signal. The Multipath Correction Section monitors the incoming signal for hysterisis, such as caused by time and frequency dispersive multipath distortion and provides correction information to the Track/Hold Logic Section.

The Inverted FSK Output of U71 is provided on the BBP-100 for use with certain types of military terminal units that required MIL STD 188C logic



LOW PASS FILTER SELECTION GUIDE				
BAUD RATE – BANDWIDTH				
BAUD	RI-RX RESISTANCE	COLOR CODE	MPC	T
45.45	820K	GRAY-RED-YEL	X	X
50.00	750K	VIOL-GRN-YEL	X	X
56.88	680K	BLUE-GRAY-YEL	X	
74.20	510K	GRN-BRN-YEL	X	X
75.00	510K	GRN-BRN-YEL		
100.0	300K	ORN-BLK-YEL		
110.0	330K	ORN-ORN-YEL	X	X
150.0	240K	RED-YEL-YEL		X
300.0	130K	BRN-ORN-YEL		
600.0	62K	BLUE-RED-ORN		

MPC-SERIES TERMINAL UNITS ARE NORMALLY SUPPLIED WITH CHANNEL FILTERS FOR 45.45 TO 75.0 BAUD OPERATIONS. THE MPC-1000T TEMPEST IS NORMALLY SUPPLIED WITH 150 BAUD CHANNEL FILTERS.

WHEN BBP-100 IS INSTALLED IN MPC-1000T TEMPEST, REPLACE CR27 WITH A JUMPER. CONNECT BBP-56 TO MPC-56. JUMPER MPC-B TO MPC-C UNDER CRT SHIELD.

NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
2. ALL CAPACITORS ARE μF.
3. ⊕ TEST POINTS & E-POINTS
4. ● SOCKET PIN IN HEADER TO INTERCONNECT TO MPC SERIES MAIN BOARD
5. ⊗ COMPONENTS NOT INSTALLED.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

DOVETRON

BBP-100 BINARY BIT PROCESSOR SCHEMATIC

APPROVALS	DATE	SIZE	DRAWING NO
DESIGN	11-30-78	D	75195
CHECKED	5-7-79	SCALE	
		DO NOT SCALE DRAWING	SHEET 1 OF 1

instead of the EIA RS232C.

ASCII 110 BAUD OPERATION

Except on special order, all Dovetron terminal units have been provided with channel filters that have been computer-optimized for Baudot baud rates up to 75 Baud.

These filters are designed in such a way that they are very useable on 110 Baud signals, provided the basic bandwidth of the terminal unit is widened.

In a standard Dovetron MPC Series, this widening can be accomplished by replacing the eight 510K resistors in the low pass filter. With the addition of the BBP-100, the widening of the terminal unit's bandwidth is accomplished by selecting the proper plug-in bandwidth module.

For optimum ASCII operation at 110 Baud, the channel filters may also be opened up. Before opening up the channel filters though, consider the fact that the terminal unit will no longer be optimum at the 45 thru 75 Baud rates.

Dovetron can supply a matched set of precision resistors to change the channel filters to 110 baud operation for $18.00 postpaid.

If the terminal unit contains a TSR-100, TSR-200 or TSR-500 assembly, NB1 and NB2 must be reprogrammed for ASCII operation. This is accomplished via the board mounted UART control switch on these assemblies. Consult manual and appropriate TSR prints.

ERRATA AND AFTERTHOUGHTS

It is normal for epoxy glass printed circuit boards to have some degree of warp after installation of components. If this warpage prevents the BBP-100 from sitting flat on the mainboard, i.e., poor connection between the side wipe sockets and the interconnecting headers, it may be necessary to drill two tie down holes in the mainboard. The tie down holes are already provided on the BBP-100. CR22 and R99 will have to be removed (they serve no function with a BBP-100 installed). Take care not to cut any existing trace on the bottom of the mainboard when drilling the auxiliary holes.

BBP-100 RETROFIT KIT PARTS LIST

1 BBP-100 Assembly, P/N 75197, with bandwidth modules for 45.45, 50.0, 56.88, 74.2/74.0 and 110 Baud rates.

6 Headers, 8 pin.

2 Spacers, 3/8 inch long.

1 Nut, 6/32 X 3/16.

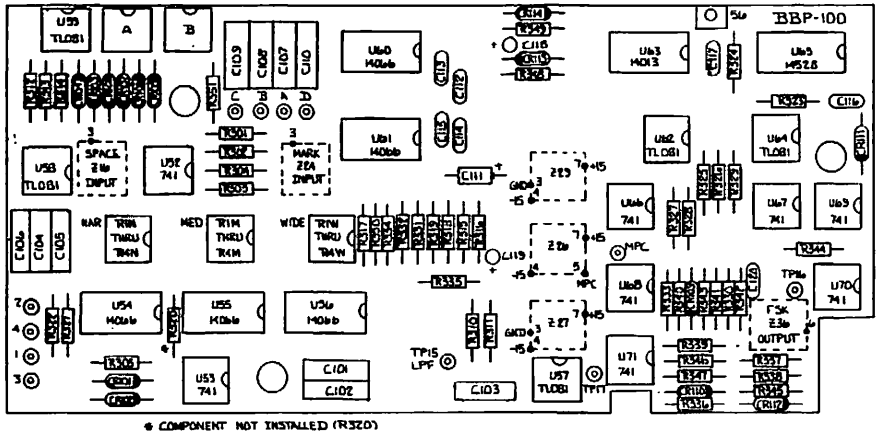
1 Switch, SPDT-CO (Optional)

1 Nylon flat washer.

1 Solder wick, 3 inches long.

6 Insulated jumpers.

SPARE B/W MODULES



* COMPONENT NOT INSTALLED (R320)

CONSULT PRINT 75195 FOR RESISTOR VALUES OF THE SELECTABLE BANDWIDTH MODULES REGARDING THE VARIOUS BAUD RATES.

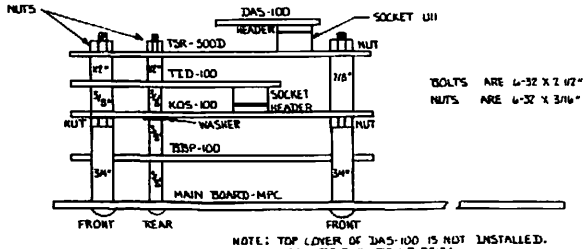
ACTIVE BANDWIDTH MODULES

STANDARD BANDWIDTH MODULES

LOCATION	BAUD RATE	WPM	RESISTANCE
NARROW	45.45	60	820K
MEDIUM	50.0	67	750K
WIDE	75.0	100	510K
A	56.88	75	680K
B	110	100 ASCII	330K

NOTE: THE INVERTED FSK OUTPUT OF U71 AT BBP-56 IS NOT USED. U71 MAY BE CONSIDERED AS A SPARE OP-AMP AND THE INVERTED FSK OUTPUT MAY BE UTILIZED FOR OTHER APPLICATIONS.

MECHANICAL INSTALLATION OF BBP 100 IN KOS-EQUIPPED MPC-1000R



NOTE: TOP COVER OF DAS-100 IS NOT INSTALLED. SEE NOTE 2 ON PRINT 75174.

ITEM	QTY	PART NO.	REF DES	DESCRIPTION	REC MANUFACTURER
36	6	CA-08PF-11	C116, 24, 26, 27 29, 36	HEADER, 8 PIN	CIRC. ASSY.
35	5	CA-08P-11		BANDWIDTH MODULES	CIRC. ASSY.
34	8	µ741	U52,53 66-71	INTEGRATED CIRCUIT	TEX. INST.
33	1	14528	U65		MOTOROLA
32	5	TL081	U57-59, 62, 64		TEX. INST.
31	5	1406b	U54-56, 60, 61		MOTOROLA
30	1	14013	U63	INTEGRATED CIRCUIT	MOTOROLA
29					
28					
27	6	METAL FILM	R312, 313, 325 326, 331, 332	RESISTOR, 20K, 1%	DALE
26	1	CARB COMP	R317	22M, 1/4W, 5%	TRW
25	1	CARB COMP	R350	5.1M	TRW
24	2	CARB FILM	R323, 324	100K	BEYSCHLAG
23	6		R315, 316, 318 319, 345, 347	47K	
22	1		R351	30K	
21	16		R305, 311, 314 320*, 321, 322 327-330, 335 336, 339, 340 342, 344	20K	
20	10		R301-304, 333, 337 338, 341, 343 346	10K	
19	1		R334	1K	
18	3	CARB FILM	R310, 348, 349	RESISTOR 470Ω 1/4W 5%	BEYSCHLAG
17					
16					
15					
14	12	IN914B	CR101-112	DIODE, SIGNAL, SIL.	IRC
13	2	IN755A	CR113, 114	DIODE, ZENER, 7.5V	ITT
12					
11					
10	3	MYLAR	C101, 103, 104	CAPACITOR, 47.00 µf	PLESSEY
9	1	MICA	C106	24.00 µf	C.D.
8	1		C105	2000 µf	C.D.
7	1		C107	390 µf	C.D.
6	2	TANTALUM	C118, 119	10 µf/16V	ITT-TAP
5	1	TANTALUM	C111	1.0 µf	SPRAGUE
4	4	MYLAR	C107-110	0.1 µf	PLESSEY
3	7	CER DISC	C117-117, 120	CAPACITOR, 0.01 µf	DILECTRON
2					
1	1	75193	BBP-100	BOARD	DOVETRON

PARTS LIST

DOVETRON

ASSEMBLY - BBP-100
BINARY BIT PROCESSOR

APPROVALS DG DATE 5-17-75

SCALE 2:1 SIZE D DRAWING NO 75192

DO NOT SCALE DRAWING SHEET 1 OF 1

DOVETRON

627 FREMONT AVE.
SOUTH PASADENA, CALIFORNIA 91030
213-682-3705

Dear OM:

The original purpose of this new product release was to announce the availability of a solid state replacement for the CRT tuning display. But we thought you might be interested in some of the other new items available from Dovetron, so they are briefly outlined below.

SSD-100 SOLID STATE CROSS DISPLAY

The CRT and the associated high voltage power supplies are the "weak link" in any solid state terminal unit. When RCA announced the discontinuance of the 2AP1A and the price soared to $50.00, Dovetron decided to improve the breed. With the availability of some new chips from the IC industry, it has been possible to condense a solid state cross display down to a practical size. The SSD-100 performs better than a CRT, does away with the high voltage supply requirement, and extends the TU's MTBF many times.

If you run out of CRTs, a SSD-100K retrofit kit will be available in December 1978 for $95.00. Installation is easy and requires about an hours work.

KOS-100 KEYBOARD OPERATED SEND

The KOS-100 has four functions:

1) Send-Receive control of TU and Transmitter-Receiver from the local keyboard. Press a "green" key and you are on the air.

2) Stores a CW ID command whenever the BREAK button is depressed for more than 1/2 second & automatically starts IDer at end of transmission.

3) Permits a remote command (such as from a timer) to force the TU into Preload, while a CW Id is sent in the middle of a transmission.

4) When the terminal unit is in SEND, switches the input of the terminal unit to the output of the AFSK tone keyer, which permits displaying the outgoing tones on the CRT or SSD-100.

A KOS-100K retrofit kit will be available in December 1978 for $49.95 postpaid USA.

DAS-100 DIGITAL AUTOSTART MODULE

The DAS-100 Digital Autostart module plugs into the TSR-500 or TSR-500D and offers a speed determination-character recognition mode of autostart. It monitors the parallel output register of the UART and when it senses a Space character (space-space-mark-space-space), sends a start command to the autostart circuit on the main board. After a discrete period of time, allowing the teleprinter's motor to come up to operating speed, it releases the contents of the Word Storage FIFO into the main Memory section of the TSR-500(D).

The DAS-100 is available from stock: $40.00 postpaid.

DOVETRON

SCL-100 SELECTIVE CALLING MODULE

INSTALLATION AND OPERATION

The SCL-100 Selective Calling Module is designed to plug into a TSR-500(D) assembly, which is normally installed in an MPC-1000R Regenerative Terminal Unit.

It may also be installed in the MPC-1000CR and MPC-1000CR/DK Regenerative Terminal Units.

FUNCTION

The SCL-100 monitors the parallel output of the receiver-section of the TSR's UART. When it receives a predetermined four-character sequence, it enables the SCL Output line, which in turn enables the terminal unit's autostart relay circuit.

Programming the predetermined four-character code is accomplished by manually setting four 5-pole DIP switches to the proper combinations of Mark and Space.

A fifth 5-pole DIP switch (labeled STOP) permits selection of a Turn-Off character. When this character is received in a four character sequence, the SCL Output line goes low, permitting the terminal unit's autostart circuits to time out.

A typical commercial Turn-On code is ZCZC, and a typical Turn-Off is NNNN. This combination would be programmed:

CHAR	1 = Z	2 = C	3 = Z	4 = C	STOP	5 = N	
SPACE	XXX	X X	XXX	X X		XX X	SPACE
MARK	X X	XXX	X X	XXX		XX	MARK

When a Turn-On code has more than four characters in it, only the last four characters are programmed.

If a Turn-On code contains a numeral or other Baudot FIGS case character, it will be necessary to consider the programming of the FIGS and LTRS characters.

An example, if the SCL-100 is to respond to a call such as NNNØMPM (N N N FIGS Ø LTRS M P N), the four character switches (from left to right) would be programmed: LTRS M P N.

All Baudot characters may be used for programming.

If the TSR-200 is being used, connect the SCL output to the top lug of the autostart mode switch as described above. The FSK position of this switch provides SEL CAL operation.

When used with the TSR-200D, disconnect the white-orange wire that is connected to the front hole of the three hole pattern to the right of Q5 on the main board.

Connect this wire to the SCL IN point. Connect the SCL Output point to the hole on the mainboard that originally has the white-orange wire connected to it.

When operated in this manner with the TSR-200D, the digital autostart feature will supply a Turn-Off (STOP) command if the STOP code is not received, etc.

VARIATIONS

When the SCL mode is added to a terminal unit, the DAS (Digital Autostart) mode is usually lost.

Since the FSK autostart mode is susceptible to noise pulses, the DAS mode may be preferred in some applications. The DAS mode may be sibstituted for the FSK mode (if the terminal unit has a three position mode switch) by removing the yellow wire from the top lug of the mode switch, and connecting a wire between the top lug of this switch and the SCL-100's OUT point, which is the front hole on the right side of the board.

With this arrangement, the scheme of operation will be MARK-SCL-DAS.

TROUBLE SHOOTING

The most probable component to cause a problem will be the electro-mechanical DIP switches. When setting these switches, use a small screwdriver or ball point pen.

When the switch is removed to the ON position, a very definite snap action will occur. When moved to the OFF position, be sure the slide lever has been moved to its furthest extreme.

With a new switch, it may be necessary to set all the contacts to the ON position initially, and then switch to OFF to assure that the contacts are indeed open.

All of the integrated circuits are CMOS and only require power at the moment that their gates are active. Since CMOS power requirement is very low, these chips will run at whatever temperature the entire terminal unit is operating at.

A hot or excessively warn CMOS chip indicates a shorted chip, which should be replaced.

DOVETRON

627 FREMONT AVE.
SOUTH PASADENA, CALIFORNIA 91030
213-682-8705

MODIFICATION OF THE KENWOOD TS-820 FOR AFSK RTTY OPERATION WITH 500 HZ CW FILTER

With the 500 Hz. CW Filter (Kenwood Part Number YG-88C) installed per Paragraph 6.2 (Page 34 of the TS-820 Operating Manual) and with the movable connector IF2 installed in Location B per Figure 25 (also on Page 34 of the Operating Manual), narrow-shift (170 Hz.) standard-tones (Mark 2125 and Space 2295) may be received thru the TS-820 with the Mode Switch set to the FSK position.

To operate the TS-820 in an AFSK configuration, it is necessary to transmit with the Mode Switch in LSB, because when in Transmit, the FSK position of the TS-820 generates its own carrier internally, which in turn is meant to be FSKed (not AFSKed).

The following modification permits AFSK operation in both LSB and FSK. The modification itself converts the FSK position of the Mode Switch to a second LSB mode, but with the 500 Hz. filter in the bandpass instead of the 2400 Hz. SSB filter.

After modification, AFSK RTTY may be transmitted in either the LSB or FSK position of the Mode Switch, and as before, may be received in either position also.

MODIFICATION

With the top and bottom covers removed from the TS-820, locate the front panel Mode Switch, S-6. Although the switch consists of 5 wafers with 10 different switch sections, Kenwood only utilizes 8 of them. Of these 8, only 5 need be modified.

For the sake of this modification, the deck closest to the front panel will be referred to as Deck 1. The last deck on the switch will be Deck 5.

With the TS-820 right-side up, and starting with the front-most deck:

DECK 1 TOP: Locate diode D2 on switch and install jumper across diode.

DECK 2 TOP: No change.

DECK 3 TOP: No change.

DECK 4 TOP: Terminal 5 has no connection on it. Install a jumper from this terminal to terminals 3 & 4 which have a Blue wire connected to them.

DECK 5 TOP: No change.

Turn the TS-820 upside-down and modify the bottom side of the Mode Switch in the following manner. Again, Deck 1 is closest to the front panel.

DECK 1 BOTTOM: Clip the two wires (one is Black and the other is White with a Red tracer) from the switch terminal. Reconnect the two wires together, but not to the terminal.

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213-682-3705

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DECK 4 TOP: Terminal 5 has no connection on it. Install a jumper from this terminal to terminals 3 & 4 which have a Blue wire connected to them.

DECK 5 TOP: No change.

Turn the TS-820 upside-down and modify the bottom side of the Mode Switch in the following manner. Again, Deck 1 is closest to the front panel.

DECK 1 BOTTOM: Clip the two wires (one is Black and the other is White with a Red tracer) from the switch terminal. Reconnect the two wires together, but not to the terminal.

DOVETRON

DECK 2 BOTTOM: Clip the White/Purple-Tracer wire from its terminal and tie back so that it cannot short to anything else. Add a jumper from this terminal to the terminal just to the left of it (looking from the front of the TS-820).

DECK 3 BOTTOM: Clip Black wire from its terminal and tie back so that it cannot short to anything else. Add a jumper from this terminal to the terminal just to the left of it (looking from the front of the TS-820).

DECK 4 BOTTOM: No change.

DECK 5 BOTTOM: No change.

With the TS-820 still upside-down, locate the X43-1110-00 board. This is the "voltage-divider" board in the center and towards the rear of the transceiver.

Locate the Orange wire that is wire-wrapped on Terminal FSB of this board.

Cut the wire loose from the FSB terminal and tie it back so that it will not short to other terminals or components.

This completes the modification of the TS-820 for narrow-filter AFSK RTTY operation with the Mode Switch in the FSK position.

Replace the TS-820 in its cabinet.

OPERATION

When the front panel Mode Switch is now placed in the FSK position, the TS-820 is actually in LSB (Lower Sideband) and the CW (500 Hz.) Filter is switched into the IF section in place of the SSB (2400 Hz.) Filter.

Connect the TS-820's PHONE PATCH OUTPUT to the audio input of the TU.

Connect the TS-820's PHONE PATCH INPUT to the AFSK output of the TU.

The tones of the AFSK Tone Keyer in the TU should be set for 2125 Hz. Mark and 2295 Hz. Space, which is 170 Hz. narrow-shift.

Tune up the TS-820 in the normal manner, switch to the LSB and set microphone gain for 50 watts output, as read on a good quality in-line wattmeter.

Switch to the FSK position. If power output drops slightly (because of additional attentuation thru the 500 Hz. CW filter), increase microphone gain slightly for 50 watts output.

When in Receive, the Passband Tuning (IF Shift) will normally be set at 10 o'clock when using the LSB position and ZERO (straight up) when operating the FSK position.

Generally, AVC should be turned OFF for lowest error-rate copy on marginal signals.

The internal Audio Monitor may be used to "keep track" of the Memory, CW-IDer, etc.

SSD-100 SOLID STATE CROSS DISPLAY

OPERATING INSTRUCTIONS

CALIBRATION

Calibration of the SSD-100 Display is accomplished by setting the two gain pots at the top edge of the SSD-100 board (R17 and R18).

The Mark Gain pot (R17) is near the front panel MARK VFO and the Space Gain pot (R18) is near the front panel SPACE VFO.

The Intensity Threshold pot (R11) is mounted halfway down the left side of the SSD-100 board.

Turn ON the MPC Series terminal unit, set the Mode switch to MS-REV and set the LEVEL control to 12 o'clock.

Tune in the Mark and Space tones from the AFSK tone keyer, using both the SSD-100 display and the individual Mark and Space LEDs mounted directly above the VFOs.

With both channels peaked for maximum amplitude, set the Mark and Space Gain pots so that four (4) LEDs on each side of the center pair (apex) are fully lit.

After a five minute warm-up, check the gain pots again. The display driver circuitry has a high degree of hysterisis and the gain in each channel may be set so that the fourth LED is "hard-on" and the fifth LED is fully off.

Set the Intensity Threshold potentiometer (R11) at mid-scale.

Block the ambient light flow to the photocell in the lower left quadrant of the display. (Use your thumb.) The light output of the display should drop to about half of the normal intensity. If not, adjust R11 so that this action occurs smoothly.

In some factory-installations, the front panel photocell replaces the board mounted photocell.

OPERATION AND INTERPRETATION

The incoming Mark signal is displayed on the horizontal line of LEDs and the space channel is displayed vertically.

The two LEDs (DS1 and DS2) at the apex of the cross are connected to the terminal unit's Signal Loss circuit.

When the two incoming tones are tuned-in properly, these two center LEDs will light, forming a complete cross.

If the terminal unit is incorrectly tuned, such as both channels tuned to the same tone, a cross will be displayed, but the center LEDs will not light, and a separate LED in the lower right-hand quadrant (DS5) will light, indicating that the terminal unit has automatically gone into Markhold.

This separate LED also lights when the terminal unit is switched to Standby (MPC-1000C) or Send (MPC-1000CR and MPC-1000R).

If the terminal unit is tuned to a steady Marking signal, the LEDs at the center of the cross will not light if the "sense" of the terminal unit is upside down. Reversing the NORMAL-REVERSE switch will cause the LEDs to light; filling in the line of lit LEDs.

A second separate LED (DS4) in the upper right quadrant monitors the high level loop supply and duplicates the indication from the front panel LOOP LED. This LED has been included in the SSD-100 display for operator convenience.

The SSD-100 also includes a unique Multipath Distortion Indicator (MDI) in the upper left quadrant. This LED (DS3) flashes in the presence of time or frequency dispersive multipath distortion. Its operation can be checked by tuning both channels of the terminal unit to the same incoming tone. The intersymbol interference generated by the RY Generator (MS-REV) will also flash this MDI LED.

The Multipath Distortion Indicator circuit consists of U3, Q2, DS3 and their associated components. To understand the validity of the MDI, it must be explained that terminal units generally use non-identical channel filters in the Mark and Space channels. For this reason, both filters exhibit their own characteristic group-response, time-delay, overshoot, ringing, etc. These non-identical filters have a tendency to distort the mark and Space channel signals unequally. The channel filters in the MPC Series terminal units are identical Bessel Function filters. Their Bessel characteristic makes them very "tame" in the presence of pulse signals (RTTY pulses in particular) and prevents ringing and overshooting.

Since they are identical, any distortion added to one channel is also added to the other channel.

The MDI monitors the output of the two channel filters. One channel is inputted to pin 8 of U3. The other channel is inputted to pin 9 of U3. This integrated circuit is a two-input NAND gate. If both channels contain amplitude energy simultaneously, the output of U3 (pin 10) goes LOW, i.e., zero. This is the normal function of a two-input NAND gate. This LOW is applied to three more NAND gates that are connected as inverters, whose outputs immediately go HIGH and drive Q2 into conduction. When Q2 conducts, the MDI (DS3) is turned on.

In this way, whenever the Mark and Space channels simultaneously

contain a significant amount of amplitude energy, the MDI will flash. By definition, time and frequency dispersive multipath distortion will flash the MDI.

The voltage dividers (R23/R25 and R24/R26) have been selected to "Flash" the MDI whenever pulse overlap at 45 to 75 bauds exceeds ten percent.

Since 10% bias distortion does not generally increase the error rate, it is best to operate the MPC Series terminal unit with the Multipath Corrector turned off. If the MDI starts to flash, turn the MPC on.

VARIATIONS AND OPTIONS

Provisions have been made for attaching an external intensity control to the SSD-100 at E-Point E2. Resistors R3 and R8 have not been installed, but locations have been provided that would provide part of an external intensity control circuit.

E-Point E1 has been provided to permit a front panel-mounted photocell at the INT location to be used instead of the board-mounted photocell.

E-Point E3 is the output of a four diode bridge (CR1-CR4). This bridge is driven by the original filament supply of the CRT (6.3 VAC at 600 mils). Since LEDs work equally well on pulsating DC, the output of this bridge supply is not filtered or regulated, and provides about 4.5 PVDC.

E3 may be bypassed with a 1000 Mfd capacitor to provide a 6.5 VDC source, capable of providing a 5.1 VDC regulated supply for possible future applications. Filtering this supply will increase the light output and power consumption of the SSD-100 display, so diode isolation is recommended. An increase in light output is not required, and increased power consumption by the bargraph display driver chips and the LEDs will only decrease their MTBF.

ADDENDUM

Two resistor locations have been provided at R21 and R22. Dovetron installs jumpers at these locations, but low impedance resistors (15-33 ohm) may be installed to limit current flow thru DS1, DS2, DS4 and DS5 in other applications.

SSD-100 SOLID STATE CROSS DISPLAY

INSTALLATION INSTRUCTIONS

FACTORY INSTALLATION OF SSD-100

When an SSD-100 Solid State Cross Display is installed in a Dovetron MPC Series terminal unit, the following components are not normally installed on the MPC main board:

F3, F3 Fuse Clips, C53, C63, C64, C65, C66, C67, CR44(4), CR45, CR46, R170, R173, R174, R175, R176, R177, R178, R179A, R179B, R180, R181, R182, R183, R184, R185, R186A, R186B, R187, R188, R190, R191, R192, R193, R194, R195 and R222.

The CRT socket and cable assembly are not installed.

R114 (originally 1K) is changed to a 68 ohm, 1/4 watt, 5%, carbon film.

Z43 (originally µ741CP) op-amp is changed to a TI-TL081CP.

The 8 pin plug-in cable assembly that connects the SSD-100 to the MPC main board is connected to various E-Points and feed-thru holes on the main board per the Installation Chart on SSD-100 Assembly/Schematic Print 75189.

FIELD RETROFIT INSTALLATION OF THE SSD-100K

The SSD-100K retrofit kit consists of an SSD-100 display assembly, an SSD bezel with optical filter, an 8 pin interconnecting cable, a replacement resistor (68 ohms) and op-amp (TL081CP), and the necessary hardware to mount the SSD-100 in place of the original CRT assembly.

Since simple modifications are many times more successful than complex ones, only those components that would interfere with the operation of the SSD-100 display are removed. The excess components may be removed if desired.

The minimum component removal consists of the following:

1) Remove and discard the CRT bezel, the mounting screws, the CRT shield, the CRT tube and the CRT socket assembly. When removing the CRT socket/cable assembly, clean out the PC holes on wires 1 (Brown) and 11 (White with tracer). These 6.3 VAC filament lines will be used to provide the high current required by the LEDs on the SSD-100 display.

2) Remove and discard the high voltage diodes at CR45 and CR46. This effectively removes high voltage from the CRT's original

high voltage power supply.

3) Remove the F3 fuse located on the bottom side of the MPC main board. The three high voltage wires from the power transformer are now isolated on the main board.

4) The high voltage filter capacitors C66 and C67 may be removed. Save C66 (40 Mfd, 350 VDC) as a spare for loop supply filter capacitor, C60.

5) Remove and discard R170 (33 ohms) near pin 8 of Z43 (XR2206C) tone keyer.

6) Remove R114 (1K) to the right of Z37 and replace it with 68 ohm resistor supplied in SSD-100K kit.

7) Remove Z43 (μ741CP) and replace with TL081CP supplied in SSD-100K kit.

8) Remove Q10, Q11 and Q12 from their sockets and save as spares for the high level loop keyer Q7. These transistors will also spare the 2N697 at Q5 and Q6 on the main board and Q1 and Q2 on the SSD-100 assembly.

9) Remove the two disc capacitors at C63 and C64.

10) Install the 8 wire interconnecting cable per the Cable Installation chart on SSD-100 Assembly/Schematic print 75189.

Normally this 8 wire cable will be color-coded per EIA standards, i.e., Brown-1, Red-2, Orange-3, Yellow-4, Green-5, Blue-6, Violet-7 and Gray-8. If the cable supplied does not have this color-coding, a color-code for that particular cable will be supplied with the kit.

The 8 wires of this cable are connected in a fairly straight line, running from front to back, right down the center-line of the terminal unit.

The following location descriptions will aid in locating the proper point for each wire. The numbers refer to the pin in the SSD-J1 connector.

1) MPC +V at TP9, which is located between TP10 and CR60.

2) MPC Jumper location C, just to the rear of CR60, and to the left of locations A and B.

3) Junction of R214 and R215. R214 is not normally installed. Connect wire to the front-most feed-thru of R214. This

location is the left of Q13 and about 1 inch from the front edge of the main board.

4) MPC Ground at TP8, which is just to the left of the large white capacitor (1.0J100) C55.

5) CRT Filament Line 1, located behind the FOCUS potentiometer, R193.

6) CRT Filament Line 11, located behind the ASTIG potentiometer, R194.

7) Space Channel. Locate the old C64 location. Follow the trace from C64 to the left and locate feed-thru on this trace at the center-line of the terminal unit.

8) Mark Channel. Locate the old C63 location. The proper location for wire 8 is the feed-thru directly behind the feed-thru used in the previous step.

MECHANICAL INSTALLATION OF SSD-100 DISPLAY AND BEZEL ASSEMBLIES

Install the SSD-100 display and SSD bezel per the mechanical drawing on SSD Assembly/Schematic print 75189. The bezel and the four bolts are installed from the front of the terminal unit, and immediately secured with four 6/32-3/16 inch nuts.

The SSD-100 display card is slipped onto these four mounting bolts, with the LED cross display side to the front of the terminal unit and with the Mark and Space Gain pots at the top of the board. Be careful not to pinch any local wires between the bolts and the SSD-100 board.

Secure the SSD-100 board in place with the second set of four 6/32-3/16 inch nuts.

ELECTRICAL INSTALLATION OF THE SSD-100 DISPLAY

The connector on the end of the 8 wire cable plugs into the SSD-J1 connector, which is located at the bottom left (viewed from the front of the SSD-100 board.

The notched corner on the top of the connector shell indicates Pin 1.

The cable is installed properly when this notched corner (Pin 1) is closest to the center of the SSD-100 board. Installing the cable backwards will damage the SSD-100 display.

If a plastic cable clamp has been supplied with the SSD-100K kit, it may be secured under the number 4 bolt at the front, center edge of the main board and used to tie down the 8-wire cable.

jumper before applying power. If the jumper is not cut, the 5.1 volt zener on the TMS-100 board will be annihilated by the +15 volts from the KOS-100 board.

PRESET TIMER OPERATION

A preset timer may be connected to the rear panel CW ID connector.

During a prolonged transmission, every time the preset timer applies a momentary ground, the terminal unit will be switched to Preload and the TID-100 Station Identifier will cycle thru a single ID sequence.

At the end of the ID sequence, the terminal unit will switch back to Operate and output any data that was entered into the terminal unit during the ID sequence.

To function properly, the preset timer should be controlled by the terminal unit, i.e., it should be reset to "zero-time" whenever the KOS-100 (and terminal unit) switch to Send, and it should be disabled when the terminal unit is in Receive.

If it is not disabled, it will issue ID commands at preset intervals while receiving traffic.

The KOS-B E-Point on the KOS-100 goes high when the KOS is in Send. This command line has been provided to control the TMS-100, per the above section, but it can also be used to control an external preset timer.

To do both functions, a diode steering circuit should be used to isolate the TMS-100 from the preset timer. Such a circuit consists of two diodes with their anodes both connected to KOS-B. The cathode of one diode will be routed to the TMS-100 E-Point. The cathode of the other diode can be brought out to the preset timer. In this way, two circuits can be controlled by KOS-B, but the two circuits have no influence on each other.

OPERATIONAL NOTES

With the KOS-100 board over-riding the Send/Receive controls of the terminal unit, it is no longer possible to leave the memory in Recirculate and to switch back to Receive to listen on the transmitting frequency.

The logical reason for this is that as long as the Memory EMPTY LED is out (and it will be out because the Memory Section still contains data), the KOS-100 holds the terminal unit in Send.

Clearing the Memory with the front panel CLEAR switch permits the

KOS-100 to immediately start its count down to time-out.

If the TSR-500D board has been removed for service, and the rear panel REGEN ON-OFF switch has been switched to OFF, KOS-R4 must be installed to provide a "psuedo" Memory Empty signal, just as if the terminal unit were an MPC-1000C or MPC-1000CR without a memory section.

If the TSR-500D is still in the terminal unit, and the Memory EMPTY LED is lit, the KOS-100 will function normally and KOS-R4 is not needed.

FIELD INSTALLATION OF KOS-100 IN THE MPC-1000R

The KOS-100 Assembly Print 75174 and Schematic Print 75177 contain a great deal of information regards the various methods of operating a KOS-100 in an MPC Series terminal unit.

When installed in an MPC-1000R with a TSR-500(D) assembly, the logic of the KOS-100 is interconnected to the logic of the TSR-500(D). When installed in an MPC-1000C or MPC-1000CR, which does not contain the TSR-500(D), the KOS-100 board must be modified by installing a 100K (R4) resistor on the KOS-100 board.

If a TID-100 is to be used with the KOS-100, R27B is installed and R27A is not installed. If the TID-100 is not used, R27A is installed and R27B is omitted.

If the KOS-100 is supplied as a retrofit kit (KOS-100K), a 16 pin high profile socket is included with the kit, which MUST be installed on the BOTTOM of the TID-100 board. This socket acts as an interface between the TID and the KOS and plugs into the 16 pin male header (J1) on the TOP of the KOS-100 board.

A mechanical drawing in the lower left corner of Print 75174 details this interconnection of the TID-100 and KOS-100 boards.

To install the KOS-100 in an MPC-1000R/TSR-500(D)/TID-100:

A) Remove the TSR-500(D) board and lay aside.
B) Disconnect the six wires connected to the TID-100, remove it from the terminal unit, and install the 16 pin high profile socket on the BOTTOM at location J1. Pin orientation is not important.
C) Remove the 2.0 inch bolts (3) in the main board that were used to support the TID-100 and TSR-500(D) assemblies.
D) Install the three 2.5 inch bolts that have been provided with the KOS-100K kit.

Do not disconnect the original wires (TID-100) from the main board of the terminal unit, as some of them will be used in the KOS installation.

When connecting wires to the E-Points at the rear edge of the KOS-100, the wires may be inserted from either the top or the bottom of the board. Some of these E-Points have been duplicated at the front edge of the KOS board, and if more convenient, may be used.

The following installation scheme is the standard factory installation as done by Dovetron and assumes that the TID-100 is also being used. In this configuration, a CW ID start command is stored in the KOS-100 whenever the local BREAK button is depressed for more than 0.5 seconds and a CW ID sequence will be automatically sent at the end of a transmission (when the Memory Empty LED comes ON), before the KOS-100 starts to time-out and switch back to Receive.

This configuration also permits a timer to be plugged into the rear panel CW ID connector command automatic CW ID sequences every ten minutes during prolonged transmissions. During these CW ID sequences, the TSR-500(D) assembly is switched from Operate to Preload, permitting the memory section to store data entered during the CW ID sequence. At the end of the sequence, the memory section is switched back to Operate and the stored data is released for transmission.

KOS-100 INTERCONNECTIONS TO THE MPC-1000R

The following instructions are detailed clarification of the INSTALLATION notes on Assembly Print 75174 and the OPERATION notes on Schematic 75177.

The term "E-Point" means "exit point" and is a connecting point on a printed circuit board where a wire may be attached. As an example, KOS-80 means Exit Point number 80 on the KOS-100 board. MPC-80 means E-Point 80 on the main board of the MPC-1000R terminal unit.

When the KOS board has an E-Point with the same number as an E-Point on the MPC board, it is a good indication that they are going to be connected together.

1) Connect a 4.0 inch wire between KOS-80 and MPC-80. PUR
   The MPC-80 connection may be made to the plated-thru hole just to the right of E-80 in the left rear corner of the MPC main board. This location was originally intended for R17A. If R17A has been installed, remove it and discard it.
2) Connect a 7.0 inch wire between KOS-TP1 and MPC-TP1. OR
   MPC-TP1 is located directly behind the large white capacitor C47) on the left side of the terminal unit.
3) Connect a 7.0 inch wire between KOS-E and the cathode side of the front panel LOOP indicator (LED). BRN
   The cathode of this LED has a green wire connected to it. Do not disconnect the green wire.

NOTE: High heat will damage the LED. If the LED is damaged, the new LED will nave to be installed with the proper polarity. The cathode of a LED is usually identified by a flat spot on the side of the LED's case next to the cathode lead, and this lead is usually the longest of the two leads.

4) Connect a 7.0 inch wire between KOS-ME and the anode side of the front panel Memory EMPTY LED. BLU
   The anode side of this LED has a green wire on it that is part of the J1 TSR cable (J1-5). If a TID-100 was installed in the MPC-1000R, this LED probably had a short green wire attached to it. This short wire can be installed in the front edge KOS-ME instead of using the 7.0 inch wire to the rear KOS-ME, but future servicing of the MPC main board will be more difficult.
5) KOS-B is not connected to the MPC at this time.
   KOS-B may be used to enable the tones of the AFSK Tone Keyer when the KOS-100 is in Send, or to reset an external preset timer, when the KOS-100 is commanded to SEND. Both functions may be accomplished by "diode-Sterring".
   AFSK Tone Control is accomplished by removing the jumper on the TMS-100 board and connecting KOS-B to the open E-Point in the left front corner of the TMS-100 Board. This mode of operation will permit VOX control of the companion transmitter, but inhibits the use of the RY Generator (MS-REV) with the terminal unit is in Receive. See Note 10 on 75177.
6) KOS J1-14 is connected to the white-yellow wire in the TSR J1 cable.

Disconnect the yellow wire that is connected to MPC-J15, but do not disconnect wire from main board. It will be used later in Step 17.

13) Connect a 6.0 inch wire between KOS-J6 and the rear panel REGEN IN connector (MPC-J6). RED

Do not disconnect either the gray or the red (jumper) wires that are already attached to MPC-J6.

14) KOS-J11 is not connected to the MPC at this time.

A remote ground applied to KOS-J11 will force the KOS-100 into the Send mode. It has been provided on the KOS-100 board for a future systems-application.

15) KOS-J9B is not connected to the MPC at this time.

Consult Note 5 on Schematic Print 75177 for information concerning the use of KOS-J9B.

16) KOS-J9A will be connected to the rear panel CW ID connector (MPC-J9).

When originally assembled by Dovetron, MPC-J9 was connected to MPC-56 with a long (12 inches) blue wire. This wire was folded up and tucked behind the CRT assembly. If a TID-100 was installed, the wire was cut at the center and both ends were connected to the TID-100 board.

Use the blue wire that is connected to the CW ID connector (MPC-J9) on the rear panel for the connection to KOS-J9A. The other blue wire will be used later in Step 19A.

17) Connect KOS-84 to MPC-84.

Use the yellow wire that was disconnected from the LOCK connector (MPC-J15) in Step 12 above.

18) Connect an 8.0 inch wire between KOS-TP10 and MPC-TP10. YLW

MPC-TP10 is located just to the right of the TU's center-line and slightly in front of the AFSK Tone Keyer chip (Z43) XR2206C.

19(A) If the TID-100 has been programmed for CW MORSE code, connect KOS-56 to the blue wire that is connected to MPC-56.

This blue wire is the other half of the blue wire that is described in Step 16 above.

B) If the TID-100 has been programmed for Baudot or ASCII

If the TID-100 was originally installed, this wire (J1-14) was connected to the PHASING E-Point on the TID-100. If the IDer was not installed, you will find J1-14 (white-yellow) still unused in the J1 cable. Fish it out of the cable harness and connect it to KOS J1-14.

7) KOS-S9 is connected to the front panel OPERATE-PRELOAD-RECIR-CULATE toggle switch (S9 on TSR print 75143).

The easiest way to do this is to locate the ORANGE wire (J1-3) in the TSR J1 cable about four (4.0) inches from the CONNECTOR end of the cable and cut this Orange wire at this point. Fish out enough of the Orange wire (using the end going to the switch) to connect to KOS-S9. The 4.0 inch section left in the connector end of the cable will not be used.

8) KOS -V will be connected to the regulated -15 volt supply on the MPC main board.

A convenient -V connection is a feed-thru just to the right of Z25 and just to the left of pin 1 of Z29. There are two feed-thrus in this area and the correct one is the feed-thru with the wide current-carrying trace on it. Use a 4.0 inch wire. RED

9) KOS-50 is the system ground connection. Connect a 4.0 inch wire between KOS-50 and MPC-50, which is directly behind the rear panel Audio Input connector.

The original TID-100 ground has connected to MPC-50 and this original wire may be used to connect to KOS-50.

10) Connect a 4.0 inch wire between KOS +V and MPC +V. ~~GRN~~ OR

MPC +V is available on the forward terminal tie point just to the right of the audio input transformer (T2). The original TID-100 +V was connected to this point and the wire is probably long enough to connect to KOS +V.

11) KOS-C, KOS-A and KOS-D will not be connected to the MPC at this time.

KOS-D is an optional inverted PTT control line and the components for this PTT line are normally not installed on the KOS-100 board.

KOS-C and KOS-A can provide a remote LED indicator to indicate when TID-100 is sending the CW ID sequence, but since this is accomplished in the MPC-1000R already, these E-Points are not used.

12) Connect a ~~6~~ 5" inch wire between KOS-J15 and the rear panel LOCK connector MPC-J15. GRY

Disconnect the yellow wire that is connected to MPC-J15, but do not disconnect wire from main board. It will be used later in Step 17.

13) Connect a 6.0 inch wire between KOS-J6 and the rear panel REGEN IN connector (MPC-J6). RED

Do not disconnect either the gray or the red (jumper) wires that are already attached to MPC-J6.

14) KOS-J11 is not connected to the MPC at this time.

A remote ground applied to KOS-J11 will force the KOS-100 into the Send mode. It has been provided on the KOS-100 board for a future systems-application.

15) KOS-J9B is not connected to the MPC at this time.

Consult Note 5 on Schematic Print 75177 for information concerning the use of KOS-J9B.

16) KOS-J9A will be connected to the rear panel CW ID connector (MPC-J9).

When originally assembled by Dovetron, MPC-J9 was connected to MPC-56 with a long (12 inches) blue wire. This wire was folded up and tucked behind the CRT assembly. If a TID-100 was installed, the wire was cut at the center and both ends were connected to the TID-100 board.

Use the blue wire that is connected to the CW ID connector (MPC-J9) on the rear panel for the connection to KOS-J9A. The other blue wire will be used later in Step 19A.

17) Connect KOS-84 to MPC-84.

Use the yellow wire that was disconnected from the LOCK connector (MPC-J15) in Step 12 above.

18) Connect an 8.0 inch wire between KOS-TP10 and MPC-TP10. YLW

MPC-TP10 is located just to the right of the TU's center-line and slightly in front of the AFSK Tone Keyer chip (Z43) XR2206C.

19(A) If the TID-100 has been programmed for CW MORSE code, connect KOS-56 to the blue wire that is connected to MPC-56.

This blue wire is the other half of the blue wire that is described in Step 16 above.

B) If the TID-100 has been programmed for Baudot or ASCII

teleprinter codes, no connection is made to KOS-56, but a 15 ohm resistor (or wire jumper) must be installed at location R42 on the KOS-100 board. Location R42 is just in front of the KOS-TP10 E-Point.

20) KOS-F is not connected to the MPC-1000R.

A +15 volts applied to KOS-F can be used to force ON the Tone Monitor section of the KOS-100.

MPC-F may be used for this application, if desired. MPC-F is the anode end of CR55, which is located in the front right corner of the MPC main board. If KOS-F is connected to MPC-F, the Tone Monitor will be turned ON whenever the front panel Receive-Send switch is put in SEND.

THIS COMPLETES THE ELECTRICAL INSTALLATION OF THE KOS-100 BOARD.

MECHANICAL INSTALLATION

Install a 3/4 inch spacer (Item37) on each of the three 2.5 inch bolts (Item 40) that were installed in the MPC main board in Step D above.

Slip the KOS-100 assembly into place on the three bolts and temporarily secure in place with a single 3/16 nut (Item 39) on the right-most bolt.

Dress the KOS-MPC interconnect wires neatly and be sure that none are pinched between the KOS-100 board and the mounting bolts and spacers.

With no signal applied, and with front panel LEVEL control set fully CCW, turn on power and measure the Combiner Offset at MPC TP3. Since TP3 is covered by the KOS-100, it can be measured from the bottom of the terminal unit or at the anode end of CR51, which is directly under the front panel mode switch on the main board. The anode end is to the left.

Adjust the voltage at this point to -400 millivolts (-0.4 volts) by adjusting R221, which is accessible thru the large hole in the KOS-100 board. This combiner offset voltage is discussed on Page 31 of the MPC-1000C section of the instruction manual. Turn off MPC-1000R.

Install a 3/8 spacer (Item36) on the two left-most bolts.

Install the modified TID-100 board on top of the KOS-100, mating the 16 pin high profile socket (TID-J1) with the 16 pin male header (KOS-J1).

Install a 3/16 inch nut (Item 39) on top of the TID-100 board and securely tighten them and the 3/16 inch nut on top of the KOS-100 board on the right-most bolt.

Following the mechanical installation print (75174), install a 3/8 inch spacer (Item 36) on the two left-most bolts and a 7/8 inch spacer (Item 38) on the right-most bolt.

CAUTION: Incorrect installation of the TSR-J1 cable will result in damage to the TSR-500(D). In installing all the TSR cables, the little flat spot in the corner of the cable connector denotes Pin 1. Pin 1 of the corresponding TSR's cable socket is indicated by the EIA standard coding. In all cases, Pin 1 is the forward, left corner of the socket.

If the TSR-500(D) has had the DAS-100 Digital Autostart module installed, a slight modification will have to be made to this module to permit proper fitting of the top lid.

Remove and discard the top cover of the DAS-100 module. It will not be used.

Clip off the top portion of the three "Fastek" board supports that originally secured the top cover of the DAS-100. Do not clip off the curved horizontal portions of these supports.

Install the DAS-100 in the TSR-U11 socket as originally installed.

THIS COMPLETES THE MECHANICAL INSTALLATION OF THE KOS-100 BOARD AND THE TERMINAL UNIT MAY BE PLACED BACK IN SERVICE.

Before installing the top lid, set the miniature toggle switch on the KOS-100 board (KOS-S1) to the Right, and set the Time-Out potentiometer (KOS-R17) to mid-scale. This mid-scale setting will provide approximately a 10 second time-out. The range of this potentiometer is 1.0 seconds to 20.0 seconds and is linear.

With an incoming signal, and with all front panel controls in their normal positions (REC-SEND switch left in REC), the REC LED (KOS-DS1) on the KOS-100 board will flicker.

When a local keyboard key is depressed, or the BREAK button is depressed, the XMIT LED (KOS-DS2) will light, indicating that the KOS-100 is in the SEND mode. The tones from the AFSK Tone Keyer will be displayed in the CRT or SSD-100 Display. At the end of the time-out period, the XMIT LED will extinguish and the KOS-100 will switch back to RECEIVE.

If the BREAK Button on the local keyboard is depressed for longer than 500 milliseconds (0.5 seconds), the TID-100 will be enabled and a CW ID sequence will be transmitted. This CW ID sequence may be seen in both the front panel cross display and in the flickering of the Memory EMPTY LED.

Consult OPERATING INSTRUCTIONS - KOS-100 (MPC-1000R/TSR-500D) for additional information.

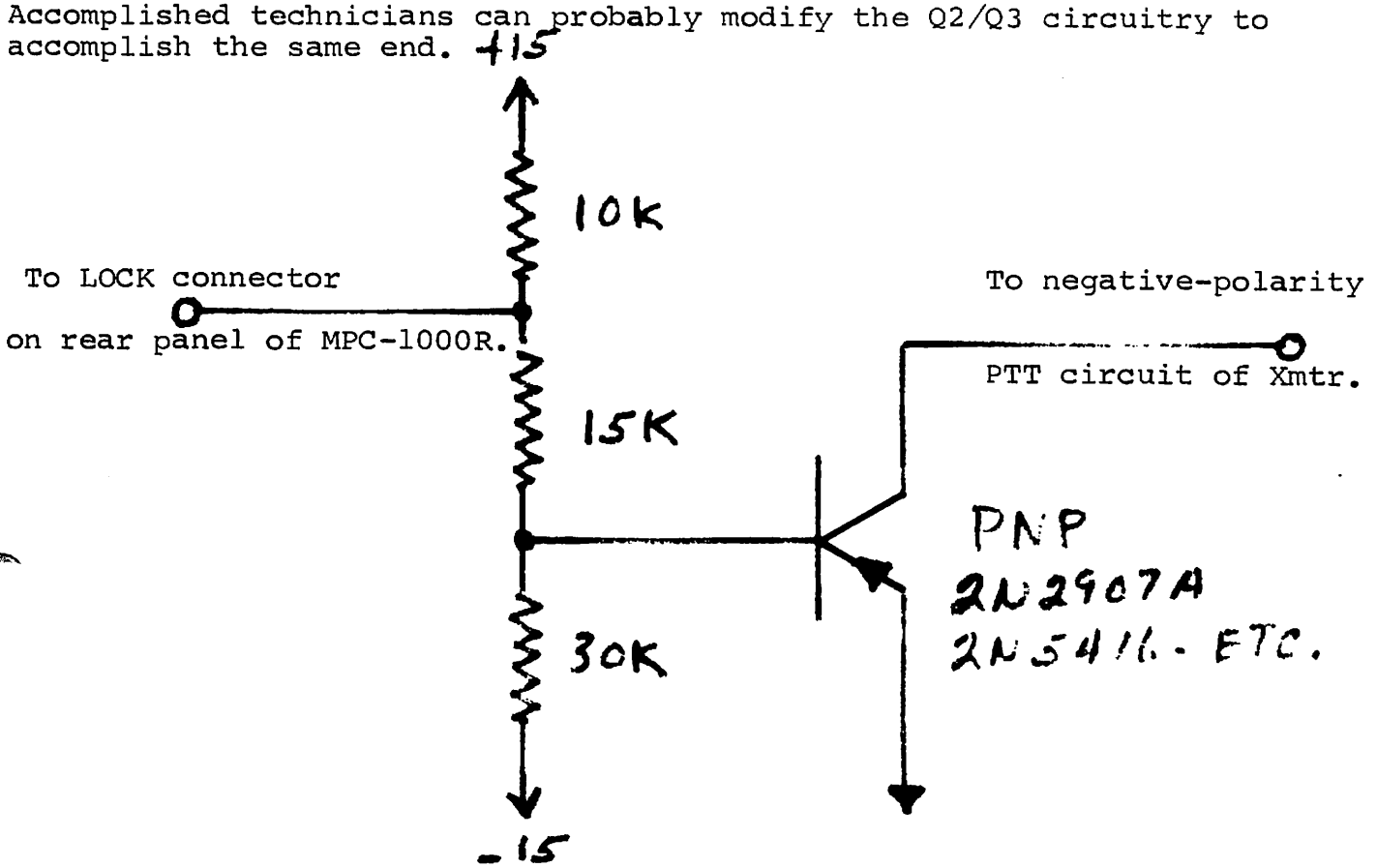
KOS-100 ADDENDUM (NEG. POL. PTT)

The open-collector transistor (KOS-Q1) that is used in the KOS-100 PTT circuit that outputs at the rear panel LOCK connector is a NPN 2N697. It is designed to work with PTT circuits that have a positive polarity referenced to ground.

If a negative polarity circuit is required, the following is offered as one method of achieving it.

Of course, a small relay could also be used.

Accomplished technicians can probably modify the Q2/Q3 circuitry to accomplish the same end.



The PNP transistor should have a PIV rating in excess of the voltage on the PTT circuit, when the PTT circuit is "open".

The current rating of the transistor should be at least two times the current pulled by the PTT circuit when it is enabled.

The three resistors may be 1/4 watt, 5%, carbon film or carbon comp.

DOVETRON

November 13, 1978

APRIL 1978

AMATEUR PRICE LIST

DOVETRON

627 FREMONT AVE.
SOUTH PASADENA, CALIFORNIA 91030
213-682-3705

It is DOVETRON's policy to sell directly to licensed Amateur Radio operators at a substantial discount. In order not to conflict with DOVETRON's "most-favored customer contract" with the U. S. Government and its agencies, all amateur orders must:

1) Be accompanied by an amateur call-sign that is verifiable in the Amateur Radio Callbook or by a QSL card, and:

2) Terms of Sales to Amateurs are PAYMENT IN FULL WITH ORDER. All prices are FOB South Pasadena. MASTERCHARGE and VISA orders are accepted.

Civilian MARS operators may purchase from this price list. Militarv MARS orders should be placed thru a military procurement office, reference GSA Contract GS-09S-37410, Class 5815.

Delivery is from Stock to 90 days ARO and shipped in same order as received, unless a U. S. Government agency intervenes with a DX priority.

MPC-1000C	Multipath-Diversity RTTY Terminal Unit with AFSK Tone Keyer and standard 20-40-60 Ma Loop Keyer:	$545.00
MPC-1000CR TSR-200	Signal Regeneration and Speed Conversion with front panel selectable Baud rate switch:	$645.00
MPC-1000CR TSR-200D	Signal Regeneration and Speed Conversion as above. Also includes Speed Determination-Character-Recognition DIGITAL AUTOSTART:	$695.00
MPC-1000R (BASIC-R) EXPANDABLE	Multipath-Diversity RTTY Terminal Unit with Tri-Tone AFSK Tone Keyer (front panel selectable) & standard 20-40-60 Ma. Loop Keyer. May be expanded with TSR assemblies and DAS-100 Digital Autostart by simply lifting the lid and plugging in proper TSR Signal Regenerator-Speed Converter Assembly:	$595.00
MPC-1000R TSR-500 DAS-100	Signal Regeneration, Speed Conversion, 200 Character FIFO Memory, Word Correction, Variable Character Rate, TD Inhibit, Blank/LTRS Diddle, Character Rate Override and DAS-100 DIGITAL AUTOSTART module:	$895.00
TSR-200	Sig. Regeneration, Speed Conversion, no Memory:	$125.00
TSR-200D	Same as TSR-200 with DIGITAL AUTOSTART circuit:	$175.00
TSR-500	Dual Uart Regenerator with 200 Char. Memory and Word Correction. Does not include DAS-100:	$295.00
DAS-100	Digital Autostart Module for use with TSR-500:	$ 40.00
TID-100	Station Identifier. Specify CW, Baudot or ASCII:	$ 39.95
	CONUS/Hawaii Shipping and Insurance (UPS):	$ 9.50

Specify: Rackmount-Tabletop, 115-230 VAC, AFSK Tones, Baud Rate, Loop I.

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DECK 2 BOTTOM: Clip the White/Purple-Tracer wire from its terminal and tie back so that it cannot short to anything else. Add a jumper from this terminal to the terminal just to the left of it (looking from the front of the TS-820).

DECK 3 BOTTOM: Clip Black wire from its terminal and tie back so that it cannot short to anything else. Add a jumper from this terminal to the terminal just to the left of it (looking from the front of the TS-820).

DECK 4 BOTTOM: No change.

DECK 5 BOTTOM: No change.

With the TS-820 still upside-down, locate the X43-1110-00 board. This is the "voltage-divider" board in the center and towards the rear of the transceiver.

Locate the Orange wire that is wire-wrapped on Terminal FSB of this board.

Cut the wire loose from the FSB terminal and tie it back so that it will not short to other terminals or components.

This completes the modification of the TS-820 for narrow-filter AFSK RTTY operation with the Mode Switch in the FSK position.

Replace the TS-820 in its cabinet.

OPERATION

When the front panel Mode Switch is now placed in the FSK position, the TS-820 is actually in LSB (Lower Sideband) and the CW (500 Hz.) Filter is switched into the IF section in place of the SSB (2400 Hz.) Filter.

Connect the TS-820's PHONE PATCH OUTPUT to the audio input of the TU.

Connect the TS-820's PHONE PATCH INPUT to the AFSK output of the TU.

The tones of the AFSK Tone Keyer in the TU should be set for 2125 Hz. Mark and 2295 Hz. Space, which is 170 Hz. narrow-shift.

Tune up the TS-820 in the normal manner, switch to the LSB and set microphone gain for 50 watts output, as read on a good quality in-line wattmeter.

Switch to the FSK position. If power output drops slightly (because of additional attentuation thru the 500 Hz. CW filter), increase microphone gain slightly for 50 watts output.

When in Receive, the Passband Tuning (IF Shift) will normally be set at 10 o'clock when using the LSB position and ZERO (straight up) when operating the FSK position.

Generally, AVC should be turned OFF for lowest error-rate copy on marginal signals.

The internal Audio Monitor may be used to "keep track" of the Memory, CW-IDer, etc.

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MODIFICATION OF THE KENWOOD TS-820 FOR AFSK RTTY OPERATION WITH 500 HZ CW FILTER

With the 500 Hz. CW Filter (Kenwood Part Number YG-88C) installed per Paragraph 6.2 (Page 34 of the TS-820 Operating Manual) and with the movable connector IF2 installed in Location B per Figure 25 (also on Page 34 of the Operating Manual), narrow-shift (170 Hz.) standard-tones (Mark 2125 and Space 2295) may be received thru the TS-820 with the Mode Switch set to the FSK position.

To operate the TS-820 in an AFSK configuration, it is necessary to transmit with the Mode Switch in LSB, because when in Transmit, the FSK position of the TS-820 generates its own carrier internally, which in turn is meant to be FSKed (not AFSKed).

The following modification permits AFSK operation in both LSB and FSK. The modification itself converts the FSK position of the Mode Switch to a second LSB mode, but with the 500 Hz. filter in the bandpass instead of the 2400 Hz. SSB filter.

After modification, AFSK RTTY may be transmitted in either the LSB or FSK position of the Mode Switch, and as before, may be received in either position also.

MODIFICATION

With the top and bottom covers removed from the TS-820, locate the front panel Mode Switch, S-6. Although the switch consists of 5 wafers with 10 different switch sections, Kenwood only utilizes 8 of them. Of these 8, only 5 need be modified.

For the sake of this modification, the deck closest to the front panel will be referred to as Deck 1. The last deck on the switch will be Deck 5.

With the TS-820 right-side up, and starting with the front-most deck:

DECK 1 TOP: Locate diode D2 on switch and install jumper across diode.

DECK 2 TOP: No change.

DECK 3 TOP: No change.

DECK 4 TOP: Terminal 5 has no connection on it. Install a jumper from this terminal to terminals 3 & 4 which have a Blue wire connected to them.

DECK 5 TOP: No change.

Turn the TS-820 upside-down and modify the bottom side of the Mode Switch in the following manner. Again, Deck 1 is closest to the front panel.

DECK 1 BOTTOM: Clip the two wires (one is Black and the other is White with a Red tracer) from the switch terminal. Reconnect the two wires together, but not to the terminal.

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COMMERCIAL PRICE LIST

MPC-1000C	Single Tone-Pair AFSK Tone Keyer & Neutral Loop:	$ 895.00
MPC-1000CR TSR-200D	Signal Regeneration, Speed Conv. & Digital Auto-start. Single Tone-Pair AFSK & Neutral Loop:	$1,095.00
MPC-1000C/DK	Dual-Keyer (polar/neutral) version of MPC-1000C:	$1,095.00
MPC-1000CR/DK	Dual-Keyer (polar/neutral) version of MPC-1000CR:	$1,295.00
MPC-1000R BASIC-R	Triple Tone-Pair AFSK Tone Keyer & Neutral Loop. Expandable with TSR-200D or TSR-500D/DAS-100:	$1,095.00
MPC-1000R TSR-200D	Triple Tone-Pair AFSK Tone Keyer & Neutral Loop. Sig. Regeneration, Speed Conv. & Dig. Autostart:	$1,295.00
MPC-1000R TSR-500D DAS-100	Triple Tone-Pair AFSK Tone Keyer & Neutral Loop. Sig. Regeneration, Speed Conv. & Dig. Autostart. 200 Character Buffer Memory and Word Correction:	$1,495.00
The above terminal units contain the SSD-100 Solid State Cross Display.	The CRT Cross Display is available on special order:	$ 100.00

MPC-1000T TEMPEST	The TEMPEST MPC-1000T is intended for low EMI, secure communications and contains a CRT Display, Automatic Multipath Corrector and the BBP-100 Binary Bit Processor with Selectable Bandwidths up to 150 Baud. Wider B/Ws are available. Outputs are MIL 188C, EIA RS232C and AFSK Ø dbm. Keyboard entry is ±5 to ±100 V polar:	$1,495.00
MPC-1000T/CR TSR-200D TEMPEST	The CR version of the TEMPEST MPC-1000T provides Signal Regeneration and Speed Conversion. A pre-programmed, non-standard Baud rate may be selected from the front panel. Digital Autostart is available at rear panel:	$1,745.00

OPTIONS FOR MPC-SERIES TERMINAL UNITS

BAL-100	Isolated/Balanced AFSK Tone Keyer Output for C, CR & R:	$ 25.00
BBP-100	Binary Bit Processor with auto MPC & Selectable Bandwidth:	$ 100.00
BBP-100K	Retrofit Kit for field installation of BBP-100:	$ 145.00
DAS-100	Digital Autostart Module for use with TSR-500D:	$ 60.00
HVP-100	Provides ±80 Volt polar operation of C/DK and CR/DK:	$ 50.00
KOS-100	Keyboard-Operated-Send with Auto Tone Monitor:	$ 75.00
KOS-100K	Retrofit Kit for field installation of KOS-100:	$ 100.00
PKC-100	Provides high level polar keyer for MPC-1000C, CR & R:	$ 200.00
SCL-100	Selective Calling Module for MPC-1000R/TSR-500D:	$ 100.00
SSD-100K	Retrofit Kit for field installation of SSD-100 Display:	$ 95.00
TSR-200D	Signal Regen., Speed Conv. & Digital Autostart assembly:	$ 250.00
TSR-200DS	Selective Calling version of TSR-200D Sig. Regenerator:	$ 350.00
TSR-500D	Signal Regen., Speed Conv. & 200 Character Memory:	$ 400.00

TBA-1000	BAUDOT-ASCII CODE TRANSLATOR with 192 Char. Buffer:	$ 395.00
TBA-1000B	BAUDOT-ASCII CODE TRANSLATOR with Buffer & Bypass Opt:	$ 445.00

ALL PRICES ARE FOB SOUTH PASADENA, CA., USA. DELIVERY: Stock to 90 days ARO

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SSD-100 SOLID STATE CROSS DISPLAY

The SSD-100 Solid State Cross Display replaces the CRT and its high voltage power supplies in the MPC-Series RTTY Terminal Units.

The display is arranged in the traditional cross pattern and consists of high intensity (4.0 millicandelas) red, rectangular LEDs (Light Emitting Diodes). The operation of the display can be best described as a "center-off, dual-bargraph" and has a typical linearity of 0.5%.

The incoming Mark signal is displayed by the horizontal row of LEDs and the Space signal is displayed vertically.

The fast response time of the LEDs provide a truer indication of signal conditions. Weak or low S/NR signals are easier to tune in, since the SSD-100 does not display the "ball of noise" or retrace lines normally seen in a CRT display.

In addition to "Instant-On" operation and greatly increased reliability, there is no degradation with age or duty-cycle. The LEDs selected for the SSD-100 have a life expectancy in excess of 100,000 hours, ten times better than a CRT.

The MTBF (Mean Time Before Failure) of the entire terminal unit is significantly increased by the removal of the heat generating CRT assembly and the high voltage components in the CRT's power supply.

A separate LED in the upper left quadrant of the cross pattern monitors the Mark and Space input channels and "flashes" in the presence of time or frequency dispersive multipath distortion, indicating a probable increase in error rate, and suggesting that the Multipath-Corrector should be turned on.

The two LEDs at the apex of the cross pattern light only if the terminal unit is properly tuned to the incoming signal, and if the sense of the signal (Normal-Reverse) is the same as the terminal unit's sense.

Separate LEDs in two other quadrants indicate the status of the internal loop, the Signal Loss circuit and the Send-Receive mode of the terminal unit, making the SSD-100 more than just a tuning indicator, but also a central display of operator-required information.

A light sensitive photocell in the fourth quadrant monitors the ambient light conditions at the operating position and automatically adjusts the light output level of the SSD-100 to a comfortable viewing level.

The front panel bezel contains an anti-glare optical filter and provides 30% more viewing area than the original CRT bezel. When turned off, the optical filter appears as a black glass window.

The SSD-100 may be viewed easily from 75 feet. Under similar conditions, a CRT display is difficult to view from 10 feet.

Three "Set and Forget" potentiometers on the SSD-100 assembly provide Mark-Gain, Space-Gain and Photocell-Threshold. All integrated circuits, transistors and the photocel plug into gold-plated sockets for ease of maintenance.

A plug-in cable connects the SSD-100 to the terminal unit's main board.

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December 1, 1978

DOVETRON

BBP-100 BINARY BIT PROCESSOR

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The two weakest links in the signal processing chain in an RTTY Terminal Unit are "bandwidth" and "axis-restoration".

Bandwidth concerns signal to noise ratio (SNR) and axis-restoration pertains to the terminal unit's ability to correctly establish the proper zero-crossings between Mark and Space. Most axis-restorers are baud rate limited and perform poorly when the Mark and Space pulses are stretched over each other by multipath distortion.

Dovetron has developed a new method of axis-restoration that includes automatic Multipath Correction and selectable bandwidth.

This Binary Bit Processor (BBP) is an integral part of the Dovetron Baseband terminal unit, which is an extremely high-performance commercial unit.

Although Dovetron had not planned to offer the BBP concept in the MPC Series, the recent development of the TEMPTEST Model MPC-1000T has made the BBP available on a single PC assembly that can be easily installed in any MPC Series terminal unit. The part number of this assembly is BBP-100.

When tested on weak, noisy signals, an MPC-1000C/BBP-100 combination showed an error rate improvement over a standard MPC-1000C of 34 times (3400%).

Rotten signals that were not readable on the standard TU were easily readable on the MPC-1000C/BBP-100.

The BBP-100 also incorporates selectable bandwidths of 45.45/50.00, 56.88, 74.2/75.0, 110 and 150 Bauds, which optimize the terminal unit for 60, 66, 75, 100, 106 and 200 WPM Baudot and 100 WPM ASCII operation.

Since the new method of Multipath Correction is fully automatic, the front panel (MPC) switch permits operator selection of any two of these bandwidths.

If the front panel switch is replaced with a "center-off" type of switch (Alco Part Number MTA-106E), three bandwidths may be selected, permitting the terminal unit to be optimized to the incoming baud rate.

Installation of the BBP-100 in a D or E Series MPC terminal unit is fairly simple. Remove 14 op-amps from their sockets, remove about a dozen capacitors from the mainboard, and snip out six resistors. The BBP-100 is plugged into the mainboard thru the now empty op-amp sockets.

In the earlier B and C Series units, six of the soldered-in op-amps must be replaced with 8-pin IC sockets to accomplish the plug-in interface between the mainboard and the BBP-100 assembly.**

The BBP-100 will start showing up in production MPC terminal units in early 1979. A BBP-100K retrofit kit for existing units will be available in January 1979.

BBP-100K Retrofit Kit: $145.00 Postpaid USA. ALCO MTA-106E SW: $3.00 PP.

*Note: To determine which Series a particular terminal unit belongs to, remove the bottom cover and check the board ID number. The "Series" is identified by the letter following the board number: A75100-D is D Series, A75100-B is B Series. Kits for B/C Series will include required sockets.

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

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SCL-100 SELECTIVE CALLING MODULE

The SCL-100 plugs into the TSR-500 or TSR-500D assembly. It provides a four character turn-on selective calling mode. The four characters are programmed into the SCL-100 via board mounted DIP switches. For turn-off, a fifth character is programmed in, and a four character sequence of this character accomplishes turn-off (ex: NNNN, HHHH, etc.). If equipped with a DAS-100, the DAS-100 will also accomplish turn-off, if no turn-off code is received, if the signal fades away, or if the sending station inverts Mark and Space or switches to a different baud rate.

The SCL-100 will be available in the first quarter of 1979 for $60.00.

TSR-200D/TSR-200DS TELEPRINTER SIGNAL REGENERATOR-SPEED CONVERTER

The TSR-200D is the Digital Autostart version of the TSR-200 (which is no longer available). It is standard equipment in the MPC-1000CR and MPC-1000CR/DK terminal units. It is also available in the MPC-1000R (Basic-R) and on special order, can be provided in the MPC-1000C.

The TSR-200D is available from stock: $175.00 postpaid USA.

The TSR-200DS is the selective calling version of the TSR-200D. It will be available in the first quarter of 1979 for $235.00 USA.

TBA-1000 BAUDOT-ASCII CODE TRANSLATOR

The TBA-1000 is a stand-alone Baudot-ASCII and ASCII-Baudot Code Translator that may be operated in either half-duplex or full-duplex circuits. The Baudot and ASCII loops may be set for either active or passive operation. In the active mode, the Baudot loop current is supplied from the TBA-1000 and may be set for 20, 40 or 60 mils. The ASCII loop is 28 VDC at 20 mils. A low level I/O is also available from both sections: EIA RS232C and MIL STD 188C. A low level TTL and a parallel I/O are available from the ASCII section.

All Baudot characters are translated from the ASCII equivalents and the ASCII CONTROL characters are also available in the form of level shifts. Some are brought out to the rear panel for peripheral control and the others are available on sockets provided on the main board, which are accessible via a rear panel port.

A 192 character FIFO buffer memory prevents over-runs when down converting from an ASCII baud rate to the slower Baudot baud rate. The Baudot speeds are front panel selectable: 45, 50, 57, 75 and 110 Baud. The ASCII speeds are switch programmable on the crystal-controlled dual clock board: 110, 150, 300, 600, 1200, 2400, 4800 and 9600 bauds.

Baudot BELL may be selected as either FIGS/S or FIGS/J. An optional bypass circuit is available that will bypass the TBA-1000 whenever it is turned off.

The TBA-1000 will be available in December 1978 for $295.00 Ham Net. With the automatic bypass feature, $345.00 Ham Net.

SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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TBA-1000 BAUDOT-ASCII CODE TRANSLATOR

The TBA-1000 is a self-contained Baudot-ASCII and ASCII-Baudot Code Translator that may be used in either Full-Duplex or Half-Duplex modes. It is packaged in a 17" X 3.5" X 9" cabinet, which may be rack mounted in a standard 19" wide rack, and operated from either 115 or 230 VAC, 40 to 400 Hz mains.

Dual crystal-controlled clocks permit Baudot baud rates of 45.45, 50.00, 56.88, 74.2-75.0 and 110 baud, which are front panel selectable.

ASCII baud rates of 110, 150, 300, 600, 1200, 2400, 4800 and 9600 baud are selectable via an 8 pole DIP switch mounted on the dual clock board.

Internal switches select the various I/O configurations. Baudot I/O may be set for high or low level. The high level, neutral I/O may be selected as either active or passive. In the active mode, loop currents of 20, 40 or 60 mils may be selected. In the passive mode, the loop current is supplied externally.

The low level Baudot I/O may be either EIA RS232C (-12 Mark, +12 Space) or MIL STD 188C (+6 Mark, -6 Space).

The ASCII I/O is also switch-selectable for high or low level neutral. In the active mode, the TBA-1000 provides 20 mils at 28 VDC. The low level interface may be either EIA RS232C, MIL STD 188C or TTL. A parallel ASCII I/O is available thru a removable cover on the rear panel and is configured as TTL.

Signal Regeneration to less than 0.5% bias distortion and up-down speed conversion are accomplished by two CMOS Universal Asynchronous Receiver-Transmitters (UARTs).

A 192 character FIFO buffer memory has been provided in the ASCII-Baudot section to prevent character over-runs when down-converting from ASCII to Baudot. A Data-Inhibit circuit automatically flags when the Memory is two/thirds full (128 characters). This memory section may be preloaded with keyboard control from the local ASCII keyboard.

A variable character rate circuit has been provided with a front panel control to permit slower than machine-speed outputting of the Baudot signal. The Blank-Fill generates BLANK Baudot characters when the Memory section is empty and may be controlled from the front panel or from the local ASCII keyboard.

In the Half-Duplex mode, Transmit-Receive functions may also be controlled from the front panel or the local ASCII keyboard. Certain remote control functions, such as LOCK, PTT, IDENT and PHASING INHIBIT are also keyboard controllable. These lines permit peripheral control.

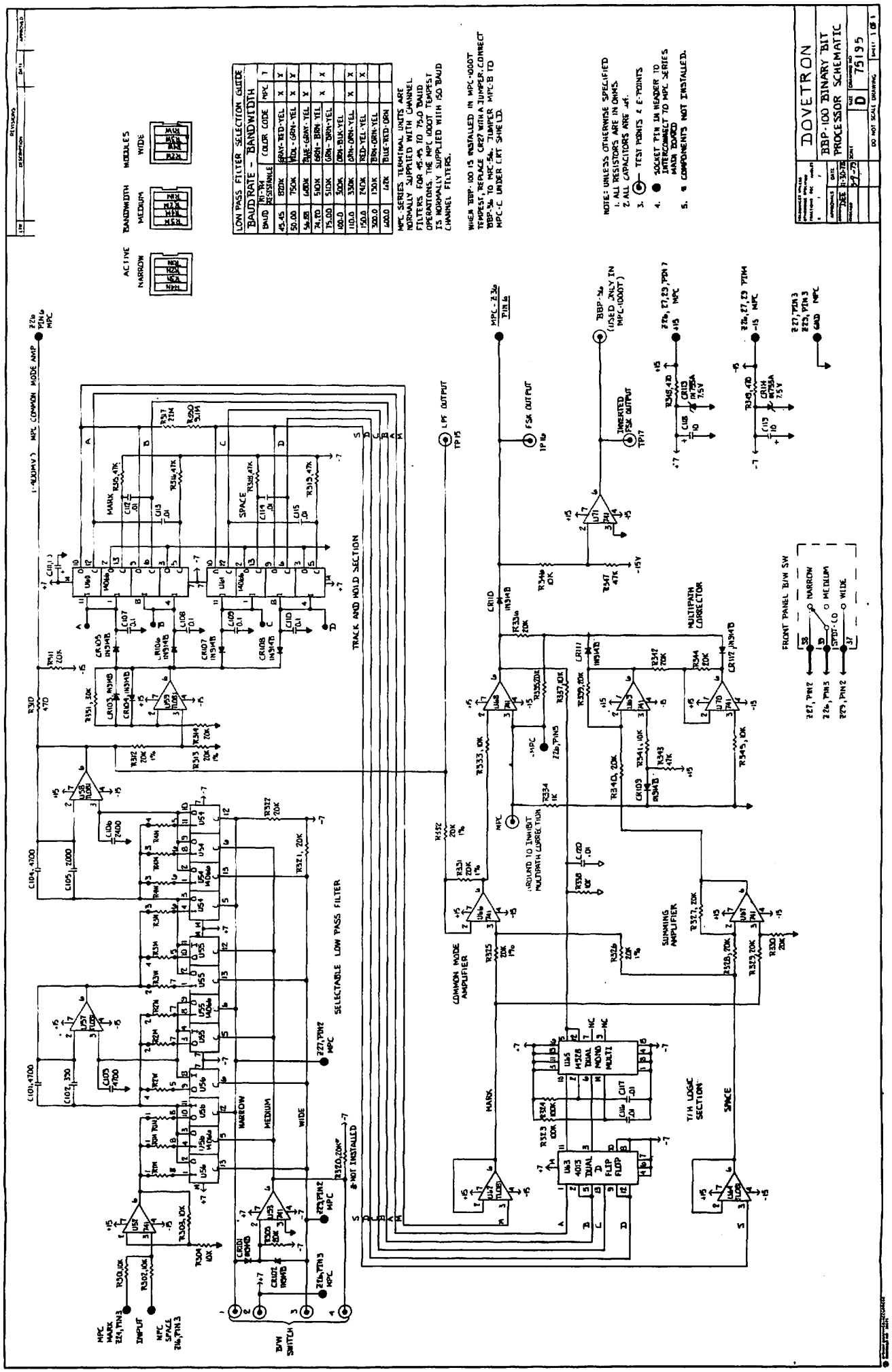
A front panel switch permits NORMAL, DOWN-SHIFT-ON-SPACE or LTRS ONLY operation. An internal switch permits the outputting of Baudot FIGS ONLY.

Five front panel LEDS monitor the status of the Memory Section: EMPTY, 1/3, 2/3 and FULL. Additional LEDs monitor the other control states and both the ASCII and Baudot high level loops.

An internal switch permits selection of Baudot FIGS/S or FIGS/J for the BELL function in the ASCII-Baudot Section. A ROM change is required to permit FIGS/J (BELL) operation in the Baudot Section (CCITT #2) and is available upon request. A TBA-1000 Bypass option is also available on special order.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

EXTRA


DOVETRON
BBP-100 BINARY BIT
PROCESSOR SCHEMATIC
75195
LOW PASS FILTER SELECTION GUIDE
BAUD RATE - BANDWIDTH
MPC SERIES TERMINAL UNITS ARE NORMALLY SUPPLIED WITH CHANNEL FILTERS FOR 45.45 TO 75.0 BAUD OPERATIONS. THE MPC 1000T TEMPEST IS NORMALLY SUPPLIED WITH 150 BAUD CHANNEL FILTERS.
WHEN TBBP-100 IS INSTALLED IN MPC-1000T TEMPEST, REPLACE CR27 WITH A JUMPER. CONNECT TBBP-34 TO MPC-34. JUMPER MPC-B TO MPC-C UNDER LAT SHIELD.
NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
2. ALL CAPACITORS ARE μF.
3. TEST POINTS & E-POINTS
4. SOCKET PIN IN HEADER TO INTERCONNECT TO MPC SERIES MAIN BOARD
5. ⊗ COMPONENTS NOT INSTALLED.
TRACK AND HOLD SECTION
SELECTABLE LOW PASS FILTER
COMMON MODE AMPLIFIER
SUMMING AMPLIFIER
MULTIPATH CORRECTOR
T/H LOGIC SECTION
FRONT PANEL B/W SW
LPF OUTPUT
FSK OUTPUT
INVERTED FSK OUTPUT
MARK
SPACE
NARROW
MEDIUM
WIDE
ACTIVE
BANDWIDTH MODULES

If it is necessary to resolder one of the resistors in the bandwidth module, it is best done with the module plugged into a socket or a piece of plastic foam to prevent any movement of the pin's alignment as the plastic header is heated up.

If it is determined that the module is okay, suspect the 14066 bilateral switch at U54, U55 or U56. These integrated circuits have a record of very excellent performance and it is more likely that you will find a folded under pin or a damaged pin in the socket.

TP16 and TP17 are both FSK outputs, and are inverted from each other. The output of TP17 is not used by a standard MPC terminal unit, which means that the 741 op-amp in location U71 may be used as a spare.

TP16 should have a square wave output. If not, check Test Points A, B, C and D that are directly in front of capacitors C107, C108, C109 and C110. A and B will have similar information on them, and C and D should be similar, but inverted from A and B.

If the problem appears to be in this area, check U59 for output at Pin 6, the two 14066 and U60 and U61 and the I.C.s in the Track and Hold Logic Section.

If a TL081CP op-amp is found to be not functioning, it may be replaced temporarily with one of the spare 741s. For maximum performance, the TL081CP is preferred in locations U57, U58, U59, U62 and U64. The latter two circuits are impedance buffers and 741s work well here, so keep TL081CP type units in the three former locations.

If the BBP-100 appears to be working properly, check Pin 6 of header Z26 for a negative 400 millivolt level with no signal input. A significantly different level at this point would indicate a problem in the low pass filter and U57 and U58 would be suspect.

THEORY OF OPERATION

A deep explanation of the theory of operation of the BBP-100 will not be attempted. It is a complicated, proprietary circuit and is in the process of being commercially protected.

Basically, the BBP-100 processes the incoming data thru a selectable bandwidth low pass filter section which strips the carrier information from the data. The data in Mark and Space form is then "tracked" in the Track and Hold Section, and the energy level of the sequential Mark and Space conditions are compared to establish the proper axis restoration point. The T/H Logic Section controls the Track and Hold Section and takes its information from the incoming signal. The Multipath Correction Section monitors the incoming signal for hysterisis, such as caused by time and frequency dispersive multipath distortion and provides correction information to the Track/Hold Logic Section.

The Inverted FSK Output of U71 is provided on the BBP-100 for use with certain types of military terminal units that required MIL STD 188C logic

DOVETRON MPC-1000R REGENERATIVE RTTY TERMINAL UNIT

MPC-1000R/BASIC ** MPC-1000R/TSR-200D ** MPC-1000R/TSR-500D

The BASIC MPC-1000R is an expandable version of the MPC-1000C with a TMS-100 Tri-Mode AFSK Tone Selector, which provides three separate sets of front panel selectable AFSK Mark-Space tone pairs for the Phase-Continuous Tone Keyer.

The Standard range of these tone pairs is 1175 Hz. to 3200 Hz. One tone pair may be extended lower in frequency by adding two resistors to the TMS-100 Assembly.

When supplied as a BASIC-R, the internal TSR cables are secured in a TSR Adapter assembly. The front panel Speed Switches and Memory Controls are non-functional. MARK & FSK Autostart are standard.

A TSR-200D Teleprinter Speed Converter-Signal Regenerator Assembly may be mounted above the TSR Adapter and interconnected with a single short cable. In this configuration (MPC-1000R/TSR-200D), the front panel Speed switches select both the signalling baud rate and the output baud rate to the local teleprinter. The Memory Controls are non-functional, since the TSR-200D does not contain a memory section. Digital Autostart is provided by the TSR-200D Assembly.

A TSR-500D Teleprinter Speed Converter-Signal Regenerator Assembly may be mounted in a Basic-R by replacing the TSR Adapter assembly with a TSR-500D assembly.

This configuration (MPC-1000R/TSR-500D) provides Signal Regeneration, Speed Conversion, a 200 Character FIFO Memory, Keyboard-controlled Word Correction, Phasing (BLANK/LTRS Diddle), Variable Character Rate, Character Rate Over-Ride, Automatic Word Storage Over-Ride, Automatic Stop-Bit Length Selection, TEE DEE Inhibit and all the other functions of the TSR-500D Assembly.

The 200 Character Memory may be Preloaded and Recirculated with either off-the-air signals or with data generated from the local teleprinter.

Digital Autostart is available if the DAS-100 Digital Autostart Module has been installed in the TSR-500D.

The RIF-100 Remote Interface Module may be installed in all three of the "R" models to provide automatic switching between Transmit and Receive upon receipt of a keyboard generated ground closure. When used with keyboards that supply a "ground" as each key is depressed, a time constant circuit maintains the terminal unit in the Transmit (Send) mode while a message is being sent.

A KOS-100 (Keyboard Operated Send) module is also available, which puts the MPC-1000R/TSR-500D into Send whenever the TU is receiving data from the local teleprinter. Any keyboard signal actuates the KOS-100 automatically. If a TID-100 Station Identifier Assembly is also installed in the terminal unit, depressing the BREAK button on the keyboard will automatically put the TU into Send, trip off the Identification sequence and switch the TU to Preload, permitting data entry when the TID-100 is sequencing. Pressing the BREAK button during a transmission commands the TID-100 to "identify" at the end of the transmission automatically.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

MPC-1000CR/DK UNIVERSAL DUAL-KEYER TERMINAL UNIT

E-SERIES

The DK (Dual-Keyer) version of the MPC-1000CR contains both a Polar and a Neutral loop keyer: MPC-1000CR/DK

Selection of either keyer is made via an internal switch.

The proper loop currents in either polar or neutral mode are also switch-selectable.

A third switch selects either Full Duplex or Half Duplex operation.

The programming instructions for these switches are etched permanently on the internal printed circuit board, permitting reprogramming without consulting the (often misplaced) instruction manual.

A Digital autostart mode is provided in addition to the standard Mark and FSK autostart modes and prevents the local teleprinter from false-starting on non-RTTY signals, up side down RTTY signals and RTTY signals that are operating at an incompatible baud rate.

If the MPC-1000CR/DK is set for 66 WPM (50 Baud), it will not autostart on 75 WPM (57 Baud) or 100 WPM (75 Baud) signals and vice versa.

This feature effectively permits remote call-up of a teleprinter by Baud ate selection. It also prevents an incompatible signal from false-starting a teleprinter and printing unintelligible garble.

The TSR-200D is completely programmable for the number of bits per character (5, 6, 7 or 8), the total number of stop bits, the stop bit requirement, odd-even parity and polarity selection for the output keyers.

The front panel Signal Speed select switch may be used for up-down speed conversion, or it may be used to select the baud rate of straight-thru regeneration.

A rear panel switch selects the power mains requirement: 100-125 VAC or 200-250 VAC. Line frequency tolerance is 40 to 450 Hz.

Rear panel connectors are provided for Dual Diversity, Selective Calling and Remote Control. The MPC-1000C makes an ideal dual diversity companion terminal unit, and the SCR-1000 Selective Calling-Recognition unit will provide Sel-Cal and Answer-Back functions.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON MPC-1000C/DK UNIVERSAL DUAL-KEYER TERMINAL UNIT

E-SERIES

The DK (Dual-Keyer) version of the MPC-1000C contains both a Polar and a Neutral high level keyer: MPC-1000C/DK.

Selection of either keyer is made via an internal switch.

The proper loop currents (20, 40 or 60 mils) in either Polar or Neutral mode are also switch-selectable.

A third switch selects either Full Duplex or Half Duplex operation.

The programming instructions for these switches are etched permanently on the the internal printed circuit board (DKB-100), permitting reprogramming without consulting the (often misplaced) instruction manual.

A rear panel switch selects the power mains requirement: 100-125 VAC or 200-250 VAC. Line frequency tolerance is 40 to 450 Hz.

Rear panel connectors are provided for Dual Diversity, Selective Calling and Remote Control.

The polar output levels are tailored for teleprinters requiring ±50/±60 volts polar loops.

The HVP-100 High Voltage Polar Adapter may be installed for those teleprinters requiring ±80 Volts polar at 20 mils of loop current.

The TSR-200D may be installed internally to provide Signal Regeneration, Digital Autostart and Speed Conversion.

When Digital Autostart is provided, it replaces the FSK mode of Autostart, since they are essentially redundant.

The standard AFSK tone keyer output is an isolated Ø dbm (600 ohms). The output level is adjustable via a rear panel mounted potentiometer.

The RIF-100 Remote Interface Module may be installed.

The KOS-100 Keyboard-Operate-Send assembly may also be installed for keyboard control of the Send/Receive functions.

EIA RS232C and MIL STD 188C FSK outputs are also available for low level polar operation. Polar inputs of ±5 to ±100 volts are acceptable without adjustment.

A rear panel 15 amp fuse is provided in the local printer's motor autostart power line.

All other specifications of the MPC-1000C/DK are similar to the MPC-1000C Multipath-Diversity RTTY Terminal Unit.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

TSR-500D TELEPRINTER SPEED CONVERTER-REGENERATOR

SIGNAL REGENERATION, SPEED CONVERSION & WORD CORRECTION

The TSR-500D is a 6.25" X 7.25" printed circuit board assembly that mounts inside of the MPC-1000R. It provides Signal Regeneration, Speed Conversion and keyboard-controlled Word Correction. With the addition of the DAS-100 Digital Autostart Module, it also provides Digital Autostart.

The 200 Character FIFO Memory Section may be Preloaded and Recirculated with either off-the-air signals or data generated at the local teleprinter.

The Dual-UART Regenerator Section regenerates incoming and outgoing signals to less than 0.5% bias distortion and permits local copy while the Memory Section is being Preloaded or Recirculated. It also permits local copy while retaining the contents of the Memory.

This Regenerator Section may be programmed by a board mounted switch for 5, 6, 7 or 8 level codes, with or without Parity, Stop Bit Verification and the total number of Stop Bits to be attached to the end of the regenerated character.

Total Stop Bit (TSB) selection permits a 1.0 or 1.5 CU Stop Bit to be affixed to the end of a 5 level Baudot character. If the UARTs are programmed for 6, 7 or 8 level codes, the TSB may be either a 1.0 or a 2.0 CU Stop Bit. When enabled, the Stop Bit Required (SBR) function forces the UARTS to reject any character that does not contain a valid Stop Bit.

The Dual Crystal-controlled Clock permits Up-Down Speed Conversion between the standard communication baud rates: 45.45, 50.00, 57.88, 74.20 (75.00) and 110.0 bauds.

Five 40 character FIFO cells comprise the 200 character Memory Section. The Input FIFO is utilized as a Word-Storage Cell for the Word Correction function. A Space character following an acceptable word transfers the word out of the Input FIFO into the main Memory Section. A keyboard generated Blank character erases the contents of the Input FIFO, thus providing a convenient method of correcting each word as it is generated.

An Automatic Word-Storage Over-Ride circuit automatically empties the contents of the Input FIFO into the Main Memory Section whenever the Input FIFO contains 39 characters. In this way, the Input FIFO can not be over-run by data that does not contain Space or Blank Characters, such as RY tapes, etc.

An Automatic Stop-Bit Length Selection circuit permits the Dual-UARTs to be programmed for 1.0 CU Stop-Bits during Receive and automatically to be switched to 1.5 CU Stop-Bits during Send, thus minimizing the error rate between two teleprinters operating with different stop bit lengths.

A Phasing Pulse mode generates either a BLANK or LTRS character when the TSR-500D is in Send and the Memory Section is empty.

Variable Character Rate is provided in the Send mode to create a better balance between the energy levels of the transmitted Mark and Space channels. An Automatic Character Rate Over-Ride circuit prevents the Memory Section from being over-run by machine speed or fast keyboard operation. A Tee Dee Inhibit circuit controls data entry from tape-pulling or memory peripherals.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

MPC-1000T -TEMPEST- RTTY TERMINAL UNIT

The Dovetron TEMPEST MPC-1000T offers a secure RTTY Terminal Unit for radio teleprinter applications.

Similar to a CRT-equipped MPC-1000C, the MPC-1000T also offers front panel selectable bandwidths for optimizing the terminal unit to the baud rate of the incoming signal, and a new method of high-performance signal assessment

This new assessor circuit, the Binary Bit Processor (BBP-100) provides extremely low error rate copy on weak, noisy and badly distorted RTTY signals

Five standard bandwidth modules are stored within the MPC-1000T: 50, 57, 75, 110 and 150 Bauds.

Any three of these bandwidth modules may be plugged into active sockets on the BBP-100, permitting operator selection of the selected bandwidth via a front panel switch.

This selectable bandwidth feature, plus the variable Mark and Space channel and the 2 inch CRT cross display, permits optimum reception of RTTY signals with various tone frequencies, shift widths and baud rates.

Field testing of the MPC-1000T with the BBP-100 Assessor has shown an improvement of as much as 34 times on poor quality signals.

The BBP-100 also provides automatic multipath correction on signals that have been distorted by time or frequency dispersive multipath propagation.

The basic design of the MPC-1000T provides full in-band diversity reception during deep selective fading, and the automatic threshold control circuit permits signal tracking thru deep flat fades.

The single ended audio input is transformer-isolated with nominal impedance of 600 ohms.

The dual FSK outputs are configured for MIL 188C and EIA RS232C serial, and may be used simultaneously.

Keyboard entry may be either MIL 188C or RS232C.

For AFSK operation, a Ø dbm output is provided from the internal phase-continuous, sine wave AFSK Tone Keyer. This tone keyer doubles as BITE self-test.

All input and output signals enter and exit thru rear panel mounted BNC connectors.

Power mains entry is thru a Sealtron 8001-14S-7P-FP (or equiv.) connector.

The MPC-1000T is designed to operate on AC lines of 115 or 230 volts, 40 - 400 Hz. Voltage tolerance is ±25%. Power consumption is 12 Watts.

A TEMPEST version of the MPC-1000CR, providing Signal Regeneration, Speed Conversion and Digital Autostart, is also available: MPC-1000CR/T.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

SSD-100 SOLID STATE CROSS DISPLAY

The SSD-100 Solid State Cross Display replaces the CRT and its high voltage power supplies in the MPC-Series RTTY Terminal Units.

The display is arranged in the traditional cross pattern and consists of high intensity (4.0 millicandelas) red, rectangular LEDs (Light Emitting Diodes). The operation of the display can be best described as a "center-off, dual-bargraph" and has a typical linearity of 0.5%.

The incoming Mark signal is displayed by the horizontal row of LEDs and the Space signal is displayed vertically.

The fast response time of the LEDs provide a truer indication of signal conditions. Weak or low S/NR signals are easier to tune in, since the SSD-100 does not display the "ball of noise" or retrace lines normally seen in a CRT display.

In addition to "Instant-On" operation and greatly increased reliability, there is no degradation with age or duty-cycle. The LEDs selected for the SSD-100 have a life expectancy in excess of 100,000 hours, ten times better than a CRT.

The MTBF (Mean Time Before Failure) of the entire terminal unit is significantly increased by the removal of the heat generating CRT assembly and the high voltage components in the CRT's power supply.

A separate LED in the upper left quadrant of the cross pattern monitors the Mark and Space input channels and "flashes" in the presence of time or frequency dispersive multipath distortion, indicating a probable increase in error rate, and suggesting that the Multipath-Corrector should be turned on.

The two LEDs at the apex of the cross pattern light only if the terminal unit is properly tuned to the incoming signal, and if the sense of the signal (Normal-Reverse) is the same as the terminal unit's sense.

Separate LEDs in two other quadrants indicate the status of the internal loop, the Signal Loss circuit and the Send-Receive mode of the terminal unit, making the SSD-100 more than just a tuning indicator, but also a central display of operator-required information.

A light sensitive photocell in the fourth quadrant monitors the ambient light conditions at the operating position and automatically adjusts the light output level of the SSD-100 to a comfortable viewing level.

The front panel bezel contains an anti-glare optical filter and provides 30% more viewing area than the original CRT bezel. When turned off, the optical filter appears as a black glass window.

The SSD-100 may be viewed easily from 75 feet. Under similar conditions, a CRT display is difficult to view from 10 feet.

Three "Set and Forget" potentiometers on the SSD-100 assembly provide Mark-Gain, Space-Gain and Photocell-Threshold. All integrated circuits, transistors and the photocel plug into gold-plated sockets for ease of maintenance.

A plug-in cable connects the SSD-100 to the terminal unit's main board.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

December 1, 1978

DOVETRON

BBP-100 BINARY BIT PROCESSOR

627 FREMONT AVE
SOUTH PASADENA, CALIFORNIA 91030
213-682-3705

The two weakest links in the signal processing chain in an RTTY Terminal Unit are "bandwidth" and "axis-restoration".

Bandwidth concerns signal to noise ratio (SNR) and axis-restoration pertains to the terminal unit's ability to correctly establish the proper zero-crossings between Mark and Space. Most axis-restorers are baud rate limited and perform poorly when the Mark and Space pulses are stretched over each other by multipath distortion.

Dovetron has developed a new method of axis-restoration that includes automatic Multipath Correction and selectable bandwidth.

This Binary Bit Processor (BBP) is an integral part of the Dovetron Baseband terminal unit, which is an extremely high-performance commercial unit.

Although Dovetron had not planned to offer the BBP concept in the MPC Series, the recent development of the TEMPTEST Model MPC-1000T has made the BBP available on a single PC assembly that can be easily installed in any MPC Series terminal unit. The part number of this assembly is BBP-100.

When tested on weak, noisy signals, an MPC-1000C/BBP-100 combination showed an error rate improvement over a standard MPC-1000C of 34 times (3400%).

Rotten signals that were not readable on the standard TU were easily readable on the MPC-1000C/BBP-100.

The BBP-100 also incorporates selectable bandwidths of 45.45/50.00, 56.88, 74.2/75.0, 110 and 150 Bauds, which optimize the terminal unit for 60, 66, 75, 100, 106 and 200 WPM Baudot and 100 WPM ASCII operation.

Since the new method of Multipath Correction is fully automatic, the front panel (MPC) switch permits operator selection of any two of these bandwidths.

If the front panel switch is replaced with a "center-off" type of switch (Alco Part Number MTA-106E), three bandwidths may be selected, permitting the terminal unit to be optimized to the incoming baud rate.

Installation of the BBP-100 in a D or E Series MPC terminal unit is fairly simple. Remove 14 op-amps from their sockets, remove about a dozen capacitors from the mainboard, and snip out six resistors. The BBP-100 is plugged into the mainboard thru the now empty op-amp sockets.

In the earlier B and C Series units, six of the soldered-in op-amps must be replaced with 8-pin IC sockets to accomplish the plug-in interface between the mainboard and the BBP-100 assembly.**

The BBP-100 will start showing up in production MPC terminal units in early 1979. A BBP-100K retrofit kit for existing units will be available in January 1979.

BBP-100K Retrofit Kit: $145.00 Postpaid USA. ALCO MTA-106E SW: $3.00 PP.

Note: To determine which Series a particular terminal unit belongs to, remove the bottom cover and check the board ID number. The "Series" is identified by the letter following the board number: A75100-D is D Series, A75100-B is B Series. Kits for B/C Series will include required sockets.

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON TID-100 TELEPRINTER IDENTIFIER

The TID-100 Teleprinter Identifier is a 5.0" X 3.5" printed circuit board assembly that is designed to mount inside of all MPC Series Rtty Terminal Units.

Although intended to be used as a Morse CW IDer, it may be programmed to output either Baudot or ASCII teleprinter codes.

When outputting a teleprinter code, the free-running clock is easily adjusted to the appropriate baud rate.

The TID-100 consists of four socket-mounted CMOS devices and a 128 bit diode-programmable matrix. The matrix is designed so that the programming diodes lay flat on the printed circuit board, making installation and code reading very easy.

Two LEDs on the board monitor the status of the internal counter circuit and the outputted code. The latter permits visual verification of the code during matrix programming.

When installed in an MPC-1000C or MPC-1000CR, a second transistor keyer displays the transmitted code sequence on the front panel Signal Loss LED.

When installed in an MPC-1000R, the code sequence is displayed on front panel Memory Empty LED. If the Phasing Pulse mode of the TSR-500D is enabled, when the TID-100 is identifying, it automatically interrupts the "diddle" signal which would otherwise interfere with the identification code that was being transmitted.

When installed with a KOS-100 Keyboard-Operate-Send assembly, the TID-100 interfaces to the KOS via a 16 pin header and mounts directly on the KOS assembly.

In this application, when the KOS-100 enables the TID-100, the MPC-1000R terminal unit is switched into Preload, which permits data to be entered into the terminal unit while the TID-100 is "identifying".

At the end of the identification cycle, the terminal unit is switched from Preload to Operate, and the preloaded contents of the Memory Section is transmitted.

If a CW ID command is initiated by the keyboard BREAK button while the Memory Section contains data, the "start" latch in the KOS-100 is held-off until the Memory Section empties, i.e., at the end of the transmission.

Power requirement of the TID-100 is one mil Standby and seven mils in Transmit.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

KOS-100 KEYBOARD-OPERATED-SEND ASSEMBLY

The KOS-100 assembly is a 5.0" X 6.0" printed circuit board assembly that mounts inside the MPC Series terminal units.

Its function is to monitor the loop line between the terminal unit and the local teleprinter, the status of the Memory Section of the TSR-500D and the stat of the TID-100 Station Identifier.

When the TID-100 is installed with a KOS-100 aseembly, their logic is interconnected thru a 16 pin header assembly.

The KOS-100 normally ignores all space transitions on the loop line that are generated within the terminal unit. When it senses a space transition that was generated outside of the terminal unit by the local keyboard, Tee Dee, etc., it switches the terminal unit into Send. A variable time-out control on the KOS-100 permits a time-out period of 1 to 10 seconds. At the end of the time-out period, the terminal unit is switched back to Receive automatically.

This effectively provides Send/Receive control of the TU right at the local keyboard.

If a TID-100 is also installed, momentarily depressing the BREAK button on the keyboard (or opening the loop line) for 0.5 seconds switches the terminal unit to Send AND to Preload AND sends a start command to the TID-100, which immediately starts its identification sequence. At the end of the ID sequence, the terminal unit is switched back to Operate and any data entered into the memory during the ID sequence is outputted normally. The time-out sequence begins when the Memory Section is empty. If the Phasing Pulse has been enabled, it is automatically turned ON during the time-out period.

During a transmission with data in the Memory Section, the BREAK button may be depressed, entering a stored command in the KOS-100 to enable the TID-100 at the end of the transmission, i.e., when the Memory Section empties.

A momentary contact closure to ground at the rear panel CW ID connector immediately forces the terminal unit into Preload and starts the ID sequence. This feature permits the use of a "timer" to automatically insert ID sequences into transmissions at selected intervals.

The KOS-100 also provides a remote Lock signal to the rear panel LOCK connector whenever it has switched the terminal unit into Send. The standard Lock command is Ground-Send and Open-Receive and is intended for remote operation of a companion transmitter/receiver via their push-to-talk (PTT) lines.

An inverted Lock command may be provided for system's use by inserting the proper components in open locations on the KOS-100 board. This circuitry may be configured for Ground-Receive and for Send: +5VDC, +15VDC, or an Open circuit.

For VOX control of the companion transmitter, the KOS-100 is also capable of enabling the AFSK tone keyer in the terminal unit only during periods of transmission.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

ADDITIONAL FEATURES - E-SERIES

The E-Series represents three years of development since the first MPC-1000 was produced, and include the following additional features:

AUTOMATIC CRT INTENSITY CONTROL A front panel-mounted photocell senses the ambient light level at the operating location and adjusts the CRT's intensity automatically to a comfortable viewing level.

AUTOMATIC THRESHOLD LEVEL CONTROL An electronic switch (J-Fet Transistor) lowers the Threshold Level of the terminal unit upon acquisition of a signal, permitting "deep-tracking" during flat fades into the noise. A similar circuit compensates for signal power-loss when operating in single channel (Mark-only or Space-only) modes.

KEYBOARD ACTUATED AUTOSTART Depressing the BREAK button at the local keyboard actuates the FSK Autostart circuit in the terminal unit, turning on the teleprinter's motor and permitting retrieval of messages left in the typing unit during unattended operation.

AUTOSTART DELAYED TIMEOUT Time-out commences with the last character sent and provides approximately 20 seconds for station identification, QSLing or normal reception.

FAST-SLOW AUTOSTART An internal control permits operator selection of autostart sensitivity and noise rejection of the Mark Autostart mode.

GOLD PLATED SOCKETS All integrated circuits and transistors are socket-mounted in gold plate side-wipe sockets for ease of maintenance & service.

INPUT AMPLIFIER PROTECTION High speed diodes protect against high voltage transients generated by external audio switching circuits and comm-center patch panels.

MARK-SPACE CHANNEL CALIBRATION The front panel VFOs are calibrated at 1275, 1360, 1445, 1575, 1700, 1870, 2000, 2125, 2295, 2425, 2550, 2775 and 2975 Hertz. Internal cal pots permit lower or higher cal points.

TONE KEYER OUTPUT A transformer isolated AFSK output is available on special order.

ADJUSTABLE HIGH LEVEL LOOP The 120 Volt internal High Level loop supply may be strapped for 20, 40 or 60 mil Neutral operation.

POLAR KEYER OPTIONS The DK Series offers both Polar and Neutral high level keyers. Polar voltages available are ±48, ±50, ±60 and ±80. Polar currents available are 20, 40 and 60 mils. Other levels available on special order. The PKC-100 Polar Keyer is also available in all standard terminal units for ±50/±60 (20, 40 or 60 Mil) polar operation.

REMOTE LOCK The standard terminal unit may be remotely switched to Send with an external +5/+15 volt signal. The RIF-100 Remote Interface module permits remote control with an external "ground" and KOS operation with teleprinters that supply a ground signal when a key is depressed. The KOS-100 (Keyboard-Operated-Send) Assembly is also available as an option for keyboard control of the terminal unit and the TID-100 Station IDer.

STANDBY INDICATOR The front panel SIGNAL LOSS LED also serves as a Standby indicator when the TU is put into Standby or Send.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

MPC E-SERIES OPTIONS

RIF-100 REMOTE INTERFACE MODULE

The RIF-100 Remote Interface Module is a 1.0" X 2.0" printed circuit card assembly that may be mounted in all MPC Series terminal units.

Standard E-Series Dovetrons are configured for "systems" operation and require a +5 to +15 VDC to be applied to the rear panel LOCK connector to remotely switch the terminal unit from Receive to Send. On the MPC-1000R, the +15 VDC is provided at a rear panel connector.

When the RIF-100 is installed, a slide switch permits selection of the standard system configuration (+5/+15-Send/Zero-Receive) or an inverted KOS configuration: Ground-Send/Open-Receive.

When set for KOS (Keyboard-Operated-Send) and used with a keyboard that generates a ground signal every time a key is depressed, a time constant circuit on the RIF-100 holds the terminal unit in Send during the short time intervals between the sequential depressing of the keys.

When installed in the MPC-1000R, the RIF-100 in KOS mode will also enable the AFSK Tone Keyer output during Send, effectively permitting VOX control of the companion transmitter.

This combination of VOX control and terminal unit Send/Receive permits keyboard control right at the local teleprinter.

PKC-100 POLAR KEYER CARD

The PKC-100 Polar Keyer option may be installed in lieu of the standard high level Neutral Keyer in the MPC-1000C, MPC-1000CR and MPC-1000R. Generally, if polar keying is required in the C and CR, the C/DK or CR/DK provide greater flexibility since they both contain switch selectable polar and neutral keyer circuits that are also current selectable.

The PKC-100 provides high level polar outputs of ±50/±60 volts at 20 to 60 mils, and polar inputs of ±5 to ±100 VDC.

HVP-100 HIGH VOLTAGE POLAR ADAPTER

The HVP-100 High Voltage Polar Adapter may be installed in an MPC-1000C/DK or MPC-1000CR/DK to provide a ±80 volts polar output at 20 mils for those teleprinters that require a ±80 volts polar drive.

ISOLATED-BALANCED AFSK TONE KEYER OUTPUT

The MPC-1000C/DK and MPC-1000CR/DK provide a transformer AFSK output, nominally Ø dbm (600 ohms). The MPC-1000C, MPC-1000CR and MPC-1000R provide a single-ended, 500 ohm resistive output of approximately 60 millivolts peak to peak, which is suitable to drive SSB transmitters. This output level may be increased up to ±10 dbm upon request. A transformer *coupled* output is available for the C, CR and R on special order.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

DAS-100 DIGITAL AUTOSTART MODULE

.ost RTTY Terminal Units that incorporate an autostart circuit use some form of Analog autostart.

The MARK mode of the Dovetron MPC-1000R is pure analog. It is designed to respond to signal energy in the Mark channel.

The FSK mode (probably a Dovetron innovation) is a mixture of analog and digital that senses a "change of state" of the analog energy in either one or both of the channels.

Being analog, both modes are susceptible to false starts from noise, static crashes, CW, AM, SSB, off-speed RTTY and other energy sources.

To overcome the shortcomings of these analog systems and their false starts, Dovetron has designed a DIGITAL AUTOSTART MODULE (DAS-100) that utilizes two purely digital techniques: Character-Recognition and Speed-Determination.

The Character-Recognition circuit "looks" for a Space character, which was chosen as the "enable" signal since it follows every word in normal communications and consequently is very repetitious.

The Speed-Determination logic rejects all Space characters that are not received at the same speed that has been selected by the front panel Signal Speed switch of the MPC-1000R/TSR-500.

In operation, the Word Storage FIFO of the TSR-500 stores the initial incoming word. When the trailing Space character is decoded, the autostart circuit is enabled, which in turn, starts up the local teleprinter.

After a short delay (which permits the teleprinter to get up to operating speed), the stored word is released into the main memory, where it is regenerated, speed-converted and sent on to the teleprinter.

At the same time, the Word Storage FIFO is brought on line as part of the main memory. This permits a smooth continuous flow of data thru the digital system and prevents the last word of a transmission from being left in memory should no Space character be sent at the end of the transmission.

This digital method of autostart virtually eliminates false starts by noise, static crashes, CW, AM, SSB, off-speed RTTY or non-RTTY signals. It does not respond to Marking carriers or CR and LF signals. It may also be used as a method of selective calling, by setting the "start-up" time-constant to require a predetermined minimum number of consecutive Space characters at the beginning of a transmission.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON SELECTIVE CALLING (SEL-CAL) OPTIONS

The purpose of Selective Calling is to permit a local teleprinter to be turned on by a coded signal from a remote sending station. This is normally done by establishing a predetermined "turn-on" code, and when this code is received, activating the local teleprinter.

Both of the Dovetron Sel-Cal options provide this type of local turn-on, and in addition, also permit the teleprinter to be turned-off by another predetermined code.

In the event that the sending station forgets to send a turn-off code, or fades away during a transmission, the local teleprinter will be timed-out by the terminal unit's digital autostart circuits.

The digital autostart circuits will also initiate time-out if the sending station inverts "sense" or changes baud rate in the middle of a transmission.

To accomplish Selective Calling in the MPC-1000CR, MPC-1000CR/DK or MPC-1000R/TSR-200(D), the original TSR assembly is replaced with the TSR-200DS.

In the MPC-1000R/TSR-500(D), an SCL-100 module is plugged directly into the TSR assembly, and interconnected to the DAS-100 Digital Autostart module.

Selective Calling may also be installed in the MPC-1000C, MPC-1000C/DK and the Basic-R version of the MPC-1000R by installing the TSR-200DS assembly in the terminal unit.

The Sel-Cal functions of both the TSR-200DS and the SCL-100 may be used even if the signal regeneration and speed conversion features of the TSR unit have been disabled, provided the signal speed switch has been set to the same baud rate as the incoming signal and the Normal-Reverse switch has been set to the proper sense.

The turn-on and turn-off codes are programmed into the Sel-Cal units via board-mounted DIP switches. As an example, the turn-on code of ZCZC may be selected by programming a Z character (MSSSM) into the first DIP switch, a C character (SMMMS) into the second DIP switch and so on for the third and fourth character.

When the ZCZC combination is decoded by the Sel-Cal circuit, a start command is sent to the autostart circuits, which in turn enables the local teleprinter.

The turn-off code is a single character that must be received in a four character sequence. If the N character is selected, four sequential Ns (NNNN) initiate autostart time-out. It is also programmed via a board-mounted DIP switch.

Normal time-out after receipt of a proper turn-off code is 20 seconds. This period may be lengthened or shortened by changing the value of a resistor on the main board of the terminal unit.

Any Baudot character of the CCITT International Telegraph Alphabet No. 2 (Murray Code) may be used in the turn-on/turn-off codes.

DOVETRON

TBA-1000 BAUDOT-ASCII CODE TRANSLATOR

The TBA-1000 is a self-contained Baudot-ASCII and ASCII-Baudot Code Translator that may be used in either Full-Duplex or Half-Duplex modes. It is packaged in a 17" X 3.5" X 9" cabinet, which may be rack mounted in a standard 19" wide rack, and operated from either 115 or 230 VAC, 40 to 400 Hz mains.

Dual crystal-controlled clocks permit Baudot baud rates of 45.45, 50.00, 56.88, 74.2-75.0 and 110 baud, which are front panel selectable.

ASCII baud rates of 110, 150, 300, 600, 1200, 2400, 4800 and 9600 baud are selectable via an 8 pole DIP switch mounted on the dual clock board.

Internal switches select the various I/O configurations. Baudot I/O may be set for high or low level. The high level, neutral I/O may be selected as either active or passive. In the active mode, loop currents of 20, 40 or 60 mils may be selected. In the passive mode, the loop current is supplied externally.

The low level Baudot I/O may be either EIA RS232C (-12 Mark, +12 Space) or MIL STD 188C (+6 Mark, -6 Space).

The ASCII I/O is also switch-selectable for high or low level neutral. In the active mode, the TBA-1000 provides 20 mils at 28 VDC. The low level interface may be either EIA RS232C, MIL STD 188C or TTL. A parallel ASCII I/O is available thru a removable cover on the rear panel and is configured as TTL.

Signal Regeneration to less than 0.5% bias distortion and up-down speed conversion are accomplished by two CMOS Universal Asynchronous Receiver-Transmitters (UARTs).

A 192 character FIFO buffer memory has been provided in the ASCII-Baudot section to prevent character over-runs when down-converting from ASCII to Baudot. A Data-Inhibit circuit automatically flags when the Memory is two/thirds full (128 characters). This memory section may be preloaded with keyboard control from the local ASCII keyboard.

A variable character rate circuit has been provided with a front panel control to permit slower than machine-speed outputting of the Baudot signal. The Blank-Fill generates BLANK Baudot characters when the Memory section is empty and may be controlled from the front panel or from the local ASCII keyboard.

In the Half-Duplex mode, Transmit-Receive functions may also be controlled from the front panel or the local ASCII keyboard. Certain remote control functions, such as LOCK, PTT, IDENT and PHASING INHIBIT are also keyboard controllable. These lines permit peripheral control.

A front panel switch permits NORMAL, DOWN-SHIFT-ON-SPACE or LTRS ONLY operation. An internal switch permits the outputting of Baudot FIGS ONLY.

Five front panel LEDS monitor the status of the Memory Section: EMPTY, 1/3, 2/3 and FULL. Additional LEDs monitor the other control states and both the ASCII and Baudot high level loops.

An internal switch permits selection of Baudot FIGS/S or FIGS/J for the BELL function in the ASCII-Baudot Section. A ROM change is required to permit FIGS/J (BELL) operation in the Baudot Section (CCITT #2) and is available upon request. A TBA-1000 Bypass option is also available on special order.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

MPC-1000CR REGENERATIVE RTTY TERMINAL UNIT

E - SERIES

The MPC-1000CR Regenerative RTTY Terminal Unit is similar to an MPC-1000C, but contains a TSR-200D Speed Converter-Signal Regenerator assembly and a front panel Signal Speed Selection switch.

In addition to the MPC-1000C's MARK and FSK Autostart modes, a Digital Autostart mode is also provided and is front panel selectable.

The Signal Speed switch permits selection of 60, 67, 75 and 100 WPM Baudot and 110 Band (100 WPM) ASCII communication signal speeds, and is used to select the baud rate of the incoming and outgoing signals.

An 8 pole DIP switch on the TSR-200D assembly is normally used to set the Regenerator's output speed to whatever is required by the local teleprinter.

The front panel Signal Speed switch selects the baud rate of the incoming-outgoing signal.

A switch mounted on the TSR-200D assembly permits the front panel switch to simultaneously select both the input and output baud rates for straight-thru (no speed conversion) operation.

Whenever the MPC-1000CR is switched to SEND (locally or remotely), the SR-200D is switched automatically from Receive to Send by solid state inversion of the two clocks.

When in the Send mode, the signal regenerated by the local teleprinter is regenerated (and speed converted if desired) to less than 0.5% bias distortion before being transmitted by the AFSK Tone Keyer.

The Regenerator Section (TSR-200D) may be programmed for 5, 6, 7 or 8 level operation, with or without Parity and with Total Stop Bit (TSB) selection. The 5 level Baudot code may be programmed for a 1.0 or 1.5 character unit Stop Bit. The 6, 7 and 8 level codes may be programmed for either 1.0 or 2.0 character unit Stop Bits.

The Regenerator Section may also be set to reject any received character that does not include a valid Stop Bit.

When the Regenerator Section is inhibited by another board mounted switch, the MPC-1000CR functions as an asynchronous MPC-1000C.

During severe propagation conditions or very weak signals, the error of the MPC-1000CR is at least 10 times better than MPC-1000C.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON TSR-200D TELEPRINTER SPEED CONVERTER-REGENERATOR

SIGNAL REGENERATION, SPEED CONVERSION & DIGITAL AUTOSTART

The TSR-200D is a 5.0" X 6.25" printed circuit board assembly that mounts inside of the MPC-1000CR (Neutral Keyer) and MPC-1000CR/DK (Neutral-Polar Keyer) RTTY Terminal Units. It may also be installed in the MPC-1000C, MPC-1000C/DK and MPC-1000R (Basic-R) Terminal Units.

The TSR-200D provides three functions: Signal Regeneration, Speed Conversion and Digital Autostart.

All incoming and outgoing signals are regenerated to less than 0.5% bias distortion, significantly lowering the error rate of badly distorted or weak RTTY signals.

The Dual Crystal-Controlled Clock permits UP-DOWN Speed conversion between the standard communication baud rates (45.45, 50.00, 57.88, 75.0 and 110).

The Digital Autostart section operates on both Character Recognition and Speed Determination principles and prevents false starts on up-side-down signals or on signals operating baud rates other than for which the Signal Speed switch has been set. It is practically impervious to false starts as normally caused by SSB, CW or noise interference.

The Regenerator Section is a CMOS Universal Asynchronous Receiver-Transmitter (UART) and may be programmed by a board-mounted switch for 5, 6, 7 or 8 level codes, with or without Parity, Stop Bit Verification and the total number of Stop Bits to be attached to the end of the regenerated character.

Stop Bit Verification, when enabled, requires that the UART receive a valid stop bit on each received character before the character will be regenerated.

Total Stop Bit (TSB) selection permits a 1.0 or 1.5 character unit Stop Bit to be affixed to the end of each regenerated character when the UART is programmed for 5 level Baudot operation.

When programmed for 6, 7 or 8 level operation, the Stop Bit selection circuit provides either a 1.0 or a 2.0 character unit Stop Bit.

The Speed Conversion feature may be enabled or inhibited with a board-mounted slide switch. When inhibited, both the input and output clock ports of the Regeneration Section are clocked from the Signal Speed section of the Dual Clock.

The Signal Regeneration circuit may be bypassed by a second board-mounted slide switch for straight-thru asynchronous operation.

The Digital Autostart feature functions regardless of the setting of the Signal Regeneration and Speed Conversion switches.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

December 1978

DOVETRON

COMMERCIAL PRICE LIST

627 FREMONT AVE
SOUTH PASADENA, CALIFORNIA 91030
213-682-3705

MPC-1000C	Single Tone-Pair AFSK Tone Keyer & Neutral Loop:	$ 895.00
MPC-1000CR TSR-200D	Signal Regeneration, Speed Conv. & Digital Auto-start. Single Tone-Pair AFSK & Neutral Loop:	$1,095.00
MPC-1000C/DK	Dual-Keyer (polar/neutral) version of MPC-1000C:	$1,095.00
MPC-1000CR/DK	Dual-Keyer (polar/neutral) version of MPC-1000CR:	$1,295.00
MPC-1000R BASIC-R	Triple Tone-Pair AFSK Tone Keyer & Neutral Loop. Expandable with TSR-200D or TSR-500D/DAS-100:	$1,095.00
MPC-1000R TSR-200D	Triple Tone-Pair AFSK Tone Keyer & Neutral Loop. Sig. Regeneration, Speed Conv. & Dig. Autostart:	$1,295.00
MPC-1000R TSR-500D DAS-100	Triple Tone-Pair AFSK Tone Keyer & Neutral Loop. Sig. Regeneration, Speed Conv. & Dig. Autostart. 200 Character Buffer Memory and Word Correction:	$1,495.00
The above terminal units contain the SSD-100 Solid State Cross Display. The CRT Cross Display is available on special order:		$ 100.00

MPC-1000T TEMPEST	The TEMPEST MPC-1000T is intended for low EMI, secure communications and contains a CRT Display, Automatic Multipath Corrector and the BBP-100 Binary Bit Processor with Selectable Bandwidths up to 150 Baud. Wider B/Ws are available. Outputs are MIL 188C, EIA RS232C and AFSK Ø dbm. Keyboard entry is ±5 to ±100 V polar:	$1,495.00
MPC-1000T/CR TSR-200D TEMPEST	The CR version of the TEMPEST MPC-1000T provides Signal Regeneration and Speed Conversion. A pre-programmed, non-standard Baud rate may be selected from the front panel. Digital Autostart is available at rear panel:	$1,745.00

OPTIONS FOR MPC-SERIES TERMINAL UNITS

BAL-100	Isolated/Balanced AFSK Tone Keyer Output for C, CR & R:	$ 25.00
BBP-100	Binary Bit Processor with auto MPC & Selectable Bandwidth:	$ 100.00
BBP-100K	Retrofit Kit for field installation of BBP-100:	$ 145.00
DAS-100	Digital Autostart Module for use with TSR-500D:	$ 60.00
HVP-100	Provides ±80 Volt polar operation of C/DK and CR/DK:	$ 50.00
KOS-100	Keyboard-Operated-Send with Auto Tone Monitor:	$ 75.00
KOS-100K	Retrofit Kit for field installation of KOS-100:	$ 100.00
PKC-100	Provides high level polar keyer for MPC-1000C, CR & R:	$ 200.00
SCL-100	Selective Calling Module for MPC-1000R/TSR-500D:	$ 100.00
SSD-100K	Retrofit Kit for field installation of SSD-100 Display:	$ 95.00
TSR-200D	Signal Regen., Speed Conv. & Digital Autostart assembly:	$ 250.00
TSR-200DS	Selective Calling version of TSR-200D Sig. Regenerator:	$ 350.00
TSR-500D	Signal Regen., Speed Conv. & 200 Character Memory:	$ 400.00

TBA-1000	BAUDOT-ASCII CODE TRANSLATOR with 192 Char. Buffer:	$ 395.00
TBA-1000B	BAUDOT-ASCII CODE TRANSLATOR with Buffer & Bypass Opt:	$ 445.00

ALL PRICES ARE FOB SOUTH PASADENA, CA., USA. DELIVERY: Stock to 90 days ARO.

MAILING ADDRESS, BOX 267, SOUTH PASADENA, CALIFORNIA 91030

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

MULTIPATH CORRECTION & IN-BAND DIVERSITY

DEFINITIONS

MULTIPATH CORRECTION: The ability of a terminal unit to re-establish the correct transitions (beginnings and endings) of the incoming Mark and Space pulses, when they have been stretched, smeared and over-lapped on each other by the time delays created by Multipath Propagation.

IN-BAND DIVERSITY: The ability of a terminal unit to automatically copy Single-Channel, i.e., Mark-Only or Space-Only signals, such as caused by Selective Fading, which is a form of Multipath Distortion.

PURPOSE

When a RTTY signal is transmitted thru the HF medium, the Mark and Space pulses are often distorted in TIME and FREQUENCY by a phenomenon known as Multipath Propagation. This simply means that the signals from the transmitter are arriving at the receiver over more than one path.

Since these paths are of different lengths, their propagation or transit times differ significantly. In the case of polar and equatorial side-paths, RTTY pulses can be delayed by as much as 95%.

This time discrepancy creates an apparent stretching of the Mark and Space pulse, because although the Mark pulse on the shortest path has terminated and the Space pulse has begun, the Mark pulse is still arriving (late) via the second (longer) path. When this common condition occurs, a terminal unit without Multipath Correction cannot differentiate between the "right" pulse and the "wrong" pulse, and at best produces a large quantity of bias distortion in its slicer and keyer circuits. Often when the pulses are stretched into an over-lap condition, they cancel each other in the terminal unit, which just contributes further to errors.

The Dovetron MULTIPATH CORRECTOR™ recognizes when a new pulse has started and when the old one should have terminated, even if the old one is still arriving via a longer path. A Multipath Combiner circuit prevents overlapping pulses from cancelling each other within the terminal unit.

Multipath Propagation also produces a form of distortion called Selective Fading. If the Mark Pulse arrives at the receiver over two different paths exactly 180 degrees out of phase, the signal is highly attenuated or even cancelled at the antenna and in the receiver.

Dovetron's IN-BAND DIVERSITY design permits the terminal unit to automatically derive all the necessary information from one channel while the second channel is missing. In fact, a second psuedo channel is generated from the information present in the one remaining channel and both are processed thru the Multipath Corrector, which eliminates the bias distortion in the one remaining channel.

This ability to generate correct information from a single channel has been expanded by AC coupling the Dual-Assessor circuits directly ahead of the MULTIPATH CORRECTOR™ to permit generation of the psuedo channel even when one channel has been invaded by a CONTINUOUSLY interferring tone.

To overcome the FREQUENCY dispersive problems of Multipath Distortion, precise computer-designed Bessell-Function filters with their equal group-delay and transient-response characteristics are used in the channel and low pass filter circuits.

DOVETRON

INSTALLATION HINTS FOR THE BBP-100K

The BBP-100 "fits like a glove" in the MPC-1000T TEMPEST terminal unit, because the "T" is equipped with high profile sockets at the six points where the BBP-100 plugs into the terminal unit's mainboard.

Most MPC-1000R units in the field are equipped with medium profile, side wipe sockets at these locations. For this reason, it is important that the BBP-100 lie flat when installed on the mainboard.

To assure a flat installation, the solder tails on BBP sockets U54, U55 and U56 should be trimmed off, preventing a mechanical interference problem with the op-amps on the main board at Z14, Z15, Z22 and Z23.

The leads of the white "box" capacitors should be no longer than the other component's leads.

When shimming the front mounting bolt, check that tightening a nut down on this bolt does not cam the rear of the BBP-100 up and out of the interface sockets.

If for any reason, a great deal of trouble is encountered in shimming this bolt, drill out the mounting hole in the BBP-100 so that it fits snugly over the original spacer. Be careful of the top trace. It is closer than it looks.

If the MPC-1000R is to be subjected to transportation shock and vibration, the rear of the BBP-100 must be tied down. When the BBP-100 is retrofitted by Dovetron, two additional mounting holes are drilled in the mainboard.

A simpler field installation is to pass a short length of wire thru the rear mounting holes to an open feed thru hole on the main board. The removal of CR22 or R99 will provide a mounting hole for the right rear mount and the left rear mount can be tied down to the plated-thru hole that is trace-connected to R62. The other end of each wire is tack-soldered to the mounting hole in the BBP-100.

It is not necessary to remove the disc bypass cap at C44 on the mainboard. Push it back out of the way so that it does not touch the BBP-100.

When removing the white caps on the main board, clip their leads short. This will make removal easier and prevent possible damage to the PC traces.

The autostart keyer transistor (Q5) may have to be pushed forward slightly to clear the right front corner of the BBP-100.

When seating the BBP-100 over the six headers, be sure that all eight pins of each header are protruding thru the BBP-100 board.

When removing the front panel MPC switch, leave a little bit of insulated wire on each switch lug to help identify which wire goes to which lug on the new switch.

The switch can be loosened by rotating it from the rear with a pair of long nose pliers. An Exacto knife or small awl may be inserted thru the switch hole from the front to lock the nut while rotating the switch during removal and replacement. For cosmetic purposes, the switch should be installed with the locating slot in the threaded bushing down.

DOVETRON

BBP-100 FIELD RETROFIT INSTALLATION

The addition of the BBP-100 Binary Bit Processor to a Dovetron MPC Series Terminal Unit provides Selectable Bandwidth, superb Axis-Restoration and hysterisis Multipath Correction. These features provide a level of performance unknown in a commercial terminal unit and care should be taken during the installation not to damage the other components of the terminal unit.

The following instructions pertain specifically to E-Series terminal units, which are identified on the bottom of the mainboard with the part number A75100-E. All MPC-1000R units are E-Series.

Before proceeding with the modification of the mainboard, compare the 8 pin sockets on the mainboard with the side-wipe type 8 pin socket used on the BBP-100 board.

If the mainboard uses the same socket, complete the modification. If the mainboard contains a "low-profile" socket, notify Dovetron and a set of six high profile sockets will be made available.

Although the modification may be accomplished with the headers plugging into low-profile sockets, the low-profile socket will not guarantee a satisfactory interface over a long period of time.

To remove a low profile socket from the mainboard, pull it off. Then remove the individual pins and clean out the holes with solder wick. Do not use a solder sucker, since these gadgets have a tendency to spray the mainboard with little balls of solder than can cause unbelieveable problems.

MAIN BOARD MODIFICATION

If the DAS-100 Digital Autostart module is installed in the TSR-500(D) assembly, remove it completely and protect the pins of the header from accidental damage.

If equipped with a TSR-500(D) assembly, remove it by removing the nuts at three locations and the four plug-in cables. Note that the bevelled corner of the cable plugs face toward the left-front of the terminal unit. This bevel indicates pin 1 in the cable. Damage to the TSR-500(D) assembly will result if these cables are re-installed backwards.

If equipped with a wired-in TID-100 Station Identifier board, remove the two wires in the left-front corner so the board may be folded back over the rear panel of the terminal unit.

If a KOS-100 assembly is installed in the terminal unit, the TID-100 may be unplugged and removed, and the KOS-100 will be folded back over the rear panel to permit access to the main board of the terminal unit.

To prepare the main board of the terminal unit for the BBP-100:

1) Remove the op-amps (10) at locations Z16, Z17, Z24, Z25, Z26, Z27, Z28, Z29, Z30 and Z36. Save these 741s for use as spares.

2) Remove the four integrated circuits at locations Z31, Z32, Z33 and Z34. Save these 14011/4011s for use as spares.

3) Locate and remove the following capacitors: C15, C16, C17, C18, C19, C20, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43 and C44.

The large white caps and the dipped mica caps should be unsoldered. Take care not to damage the plated-thru holes as the caps are removed. These plated-thru holes form part of the terminal unit's continuity of circuitry. If you suspect a damaged hole, i.e., no continuity from one side of the board to the other, insert a small wire in the hole and solder both sides of the board.

The small dipped tantalums and ceramic disc capacitors may be snipped out in the interest in time. These items are being removed only because they will mechanically interfere with the BBP-100 assembly.

4) Remove resistors R45, R46, R70, R71, R75 and R79. Replace each with a jumper wire.

5) Remove the potentiometer at R221. (Discard.)

6) Remove the resistors at R74, R76, R77, R80 and R81. These may be snipped out.

INSTALLATION OF BBP-100 BOARD

1) Install an 8 pin header in each of the main board sockets Z16, Z24, Z26, Z27, Z29 and Z36. The long pins go into the sockets and the short pins (blades) will stick up thru the BBP-100 board. The pin location bevel is not important.

2) Before putting the BBP-100 down on top of the 8 pin headers, install one of the 3/8 inch spacers on the long bolt that will pass thru the hole at the front edge of the BBP-100.

A nylon flat washer has been provided, but may not be needed to level the BBP-100.

3) Slip the BBP-100 onto the long bolt and carefully orient the BBP-100 board onto the six 8 pin headers.

There are two areas of possible interference:

If the orange wire running to the terminal strip next to the audio input transformer is too short, it may interfere. If it does, replace it with a longer wire.

There are two types of 741 op-amps used in the Dovetron terminal units. One has a higher profile than the other. The 741s on the BBP-100 are the low profile type. If high profile types are mounted

on the main board at locations Z14, Z15, Z22, Z23, Z2 and Z38, they may prevent the BBP-100 from laying down flat on the 8 pin headers. Although that will not impair performance in any way, it is a good idea to interchange the high profile 741s on the main board in these locations with six of the low profile 471s supplied on the BBP-100 board. Be sure to orient the ICs properly in their sockets. If in doubt, don't change them.

4) With the BBP-100 resting flat on the headers, carefully solder the top blades of each header to the BBP-100 board. If either of the boards appear to have some warp to it, push down on the BBP-100 while soldering to assure that the blade of the header comes thru its hole on the BBP-100.

Although it is not necessary to remove any flux residue from the header section of the BBP-100, the board may be cleaned with alcohol or shellac thinner (denatured alcohol).

The BBP-100 may be removed for clean up. If for any reason, a header pin becomes damaged, consult print 75192 and the board. You will note that not all the pins are used electrically. A non-active pin may be removed from the header and re-inserted in place of a damaged active pin. Pin removal is accomplished by heating the top short end of the pin and pushing the pin up thru the board while the solder and plastic are hot. Excess solder can be wicked out. Solder suckers should not be used, since they have a tendency to spray the board with small balls of solder, which can cause unbelievable problems.

With the BBP-100 installed, the terminal unit may be reassembled. Using the hardware originally supplied with the terminal unit and those additional items supplied with the retrofit kit, reinstall the original accessories.

As now configured the MPC switch on the front panel offers two bandwidths: WIDE and NARROW. As shipped from Dovetron, this will provide bandwidths of 45.45 Baud and 74.2/75 Baud, which corresponds to 60 and 100 WPM Baudot operation.

The Wide position is MPC (UP) and the Narrow position is OFF (DOWN).

MEDIUM BANDWIDTH SELECTION

The BBP-100 Binary Bit Processor has been designed in such a way that when neither Wide nor Narrow positions are selected, the BBP-100 automatically sets itself to the Medium bandwidth position.

This permits selection of the Medium bandwidth by replacing the front panel SPDT (MPC ON-OFF) with a three position switch with a Center-OFF position.

To install a SPDT-CO switch, clip the existing wires at the switch.

You may be able to remove the switch without removing the front panel,

since the front panel is counter-bored from the rear and will capture the front nut when the switch is removed.

If it is necessary to remove the front panel to replace the switch, remove all the front panel knobs, the cross display's bezel and the chrome handles.

After the new switch is installed, replace the accessory boards. Consult the prints for a recommended stacking arrangement, using the various spacers supplied.

SELECTION OF BANDWIDTH MODULES

As supplied by Dovetron, the Wide position contains a 74.2/75 Baud bandwidth module, the Medium position contains a 50 Baud module and the Narrow position contains a 45.45 Baud module.

Two additional modules are stored in Storage sockets A and B at the left rear of the BBP-100 board and may be interchanged with the three active modules.

The bandwidth of each module is determined by the value of the resistors installed in the module itself. Consult the prints for the relationship between resistance value and bandwidth (Baud rate).

If 110 Baud operation is anticipated, a good combination for the active modules would be 110 Baud, 74.2/75 Baud and 50 Baud.

The difference between 45 and 50 Baud bandwidths is normally not apparent. In fact, it turns out that a slightly wider than optimum bandwidth is often helpful on poor quality signals.

TROUBLE SHOOTING AND TESTING

The best way to test the BBP-100 is to switch the terminal unit to MS-REVERSALS and tune the Mark and Space channels for a normal cross display.

Signal input to the BBP-100 is on Pin 3 of the Z16 and Z24 headers and is the output of the Precision Detectors on the mainboard at Pin 6 of Z15 and Z23 respectively.

Pin 6 of U52 on the BBP-100 board is the sum of the two input signals.

From this point, the signal is processed thru the two section low pass filter.

The output of the low pass filter is at TP15 on the BBP-100 board.

If the signal is present at TP15, switch the front panel Bandwidth switch thru its positions and notice the change that occurs in the low pass filter output. If one bandwidth does not appear to be working, check the bandwidth module for that position. Look for a solder bridge between two adjacent resistors and/or a poor solder connection.

If it is necessary to resolder one of the resistors in the bandwidth module, it is best done with the module plugged into a socket or a piece of plastic foam to prevent any movement of the pin's alignment as the plastic header is heated up.

If it is determined that the module is okay, suspect the 14066 bilateral switch at U54, U55 or U56. These integrated circuits have a record of very excellent performance and it is more likely that you will find a folded under pin or a damaged pin in the socket.

TP16 and TP17 are both FSK outputs, and are inverted from each other. The output of TP17 is not used by a standard MPC terminal unit, which means that the 741 op-amp in location U71 may be used as a spare.

TP16 should have a square wave output. If not, check Test Points A, B, C and D that are directly in front of capacitors C107, C108, C109 and C110. A and B will have similar information on them, and C and D should be similar, but inverted from A and B.

If the problem appears to be in this area, check U59 for output at Pin 6, the two 14066 and U60 and U61 and the I.C.s in the Track and Hold Logic Section.

If a TL081CP op-amp is found to be not functioning, it may be replaced temporarily with one of the spare 741s. For maximum performance, the TL081CP is preferred in locations U57, U58, U59, U62 and U64. The latter two circuits are impedance buffers and 741s work well here, so keep TL081CP type units in the three former locations.

If the BBP-100 appears to be working properly, check Pin 6 of header Z26 for a negative 400 millivolt level with no signal input. A significantly different level at this point would indicate a problem in the low pass filter and U57 and U58 would be suspect.

THEORY OF OPERATION

A deep explanation of the theory of operation of the BBP-100 will not be attempted. It is a complicated, proprietary circuit and is in the process of being commercially protected.

Basically, the BBP-100 processes the incoming data thru a selectable bandwidth low pass filter section which strips the carrier information from the data. The data in Mark and Space form is then "tracked" in the Track and Hold Section, and the energy level of the sequential Mark and Space conditions are compared to establish the proper axis restoration point. The T/H Logic Section controls the Track and Hold Section and takes its information from the incoming signal. The Multipath Correction Section monitors the incoming signal for hysterisis, such as caused by time and frequency dispersive multipath distortion and provides correction information to the Track/Hold Logic Section.

The Inverted FSK Output of U71 is provided on the BBP-100 for use with certain types of military terminal units that required MIL STD 188C logic

instead of the EIA RS232C.

ASCII 110 BAUD OPERATION

Except on special order, all Dovetron terminal units have been provided with channel filters that have been computer-optimized for Baudot baud rates up to 75 Baud.

These filters are designed in such a way that they are very useable on 110 Baud signals, provided the basic bandwidth of the terminal unit is widened.

In a standard Dovetron MPC Series, this widening can be accomplished by replacing the eight 510K resistors in the low pass filter. With the addition of the BBP-100, the widening of the terminal unit's bandwidth is accomplished by selecting the proper plug-in bandwidth module.

For optimum ASCII operation at 110 Baud, the channel filters may also be opened up. Before opening up the channel filters though, consider the fact that the terminal unit will no longer be optimum at the 45 thru 75 Baud rates.

Dovetron can supply a matched set of precision resistors to change the channel filters to 110 baud operation for $18.00 postpaid.

If the terminal unit contains a TSR-100, TSR-200 or TSR-500 assembly, NB1 and NB2 must be reprogrammed for ASCII operation. This is accomplished via the board mounted UART control switch on these assemblies. Consult manual and appropriate TSR prints.

ERRATA AND AFTERTHOUGHTS

It is normal for epoxy glass printed circuit boards to have some degree of warp after installation of components. If this warpage prevents the BBP-100 from sitting flat on the mainboard, i.e., poor connection between the side wipe sockets and the interconnecting headers, it may be necessary to drill two tie down holes in the mainboard. The tie down holes are already provided on the BBP-100. CR22 and R99 will have to be removed (they serve no function with a BBP-100 installed). Take care not to cut any existing trace on the bottom of the mainboard when drilling the auxiliary holes.

BBP-100 RETROFIT KIT PARTS LIST

1 BBP-100 Assembly, P/N 75197, with bandwidth modules for 45.45, 50.0, 56.88, 74.2/74.0 and 110 Baud rates.

6 Headers, 8 pin.

2 Spacers, 3/8 inch long.

1 Nut, 6/32 X 3/16.

1 Switch, SPDT-CO (Optional)

1 Nylon flat washer.

1 Solder wick, 3 inches long.

6 Insulated jumpers.

Modifications

8 MARCH 79

ON MY UNIT I HAVE INHIBITED THE AFSK IN THE RECIEVE MODE AS OUTLINED ON PP 25 (+15 on anode of CR56). The WIRE TO The "E" POINT ON TRI mode Selector Board IS a Black #22 WIRE routed around the Right Side of the TU and across The rear & then UP TO The TMS100 BOARD

16 MARCH

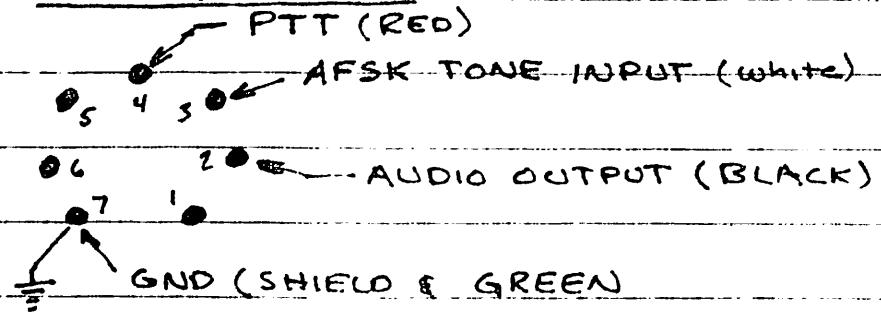
1) I connected the Diversity Plugs as Per Page 75 By moving orange on J2 (space) from E53 to E51 Yellow on J3 (mark) from E54 to E52

2) Installed TSR-200D as PER ADDENDUM

28 May

I installed the BBP as per instructions When it was fired up the signal loss indicator was on... It goes off after warmup but seems screwy. Baud filtersare as delivered.

CLEGG PLUG



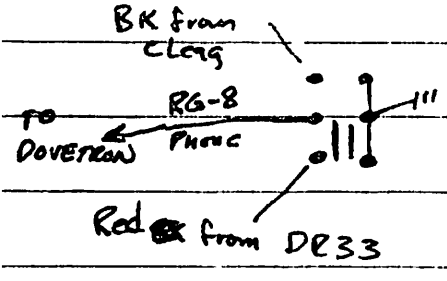
PLUGS FOR DOUETRON

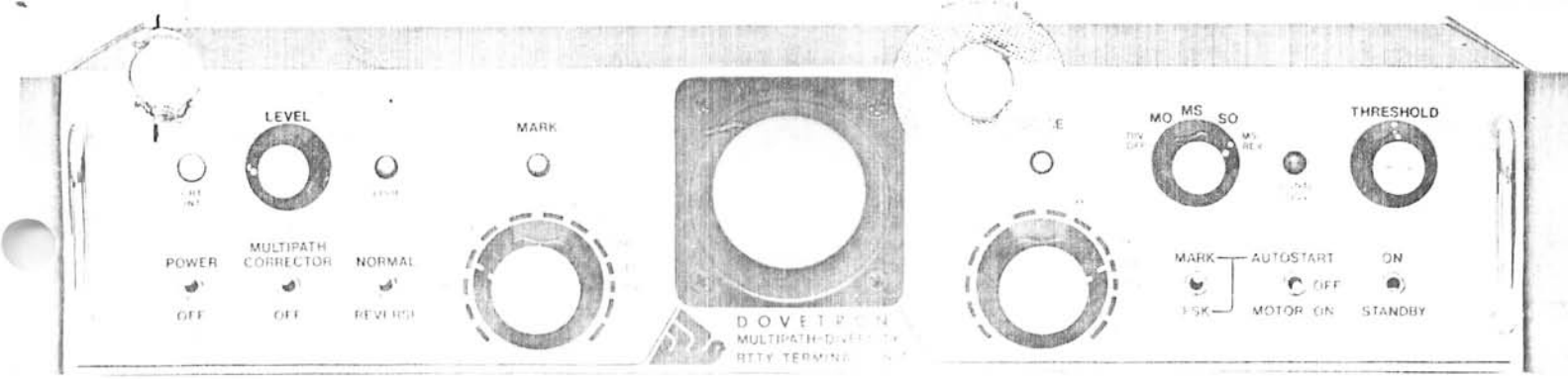
BLACK RG-8 w/ PHONO - AFSK OUTPUT

GREY Shielded w/ Phono - PTT - Remote B

BLACK RG-8 w/ Phone - AUDIO to DOUETRON

R&W TWISTED AUDIO From DR33





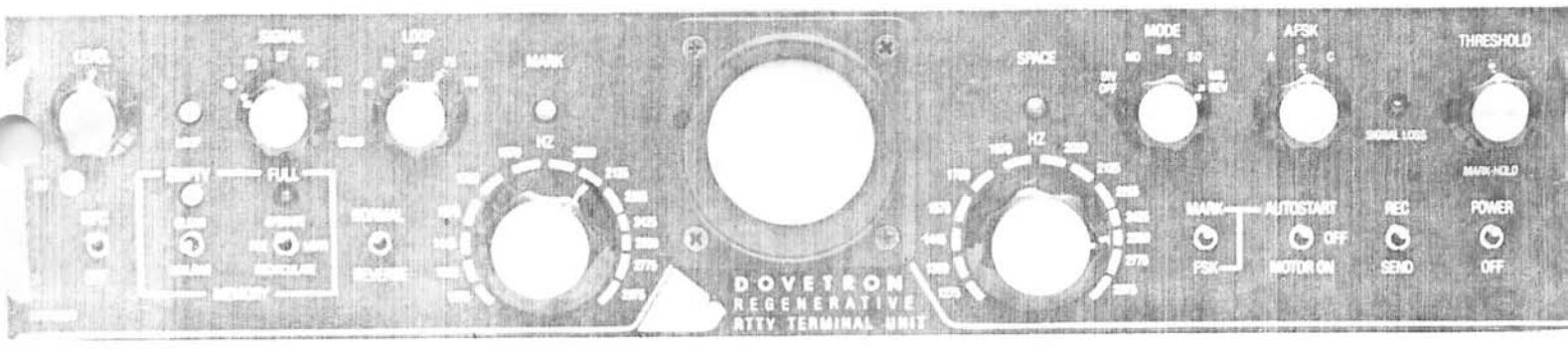
DOVETRON MPC-1000

MULTIPATH-DIVERSITY RTTY TERMINAL UNIT

FEATURES

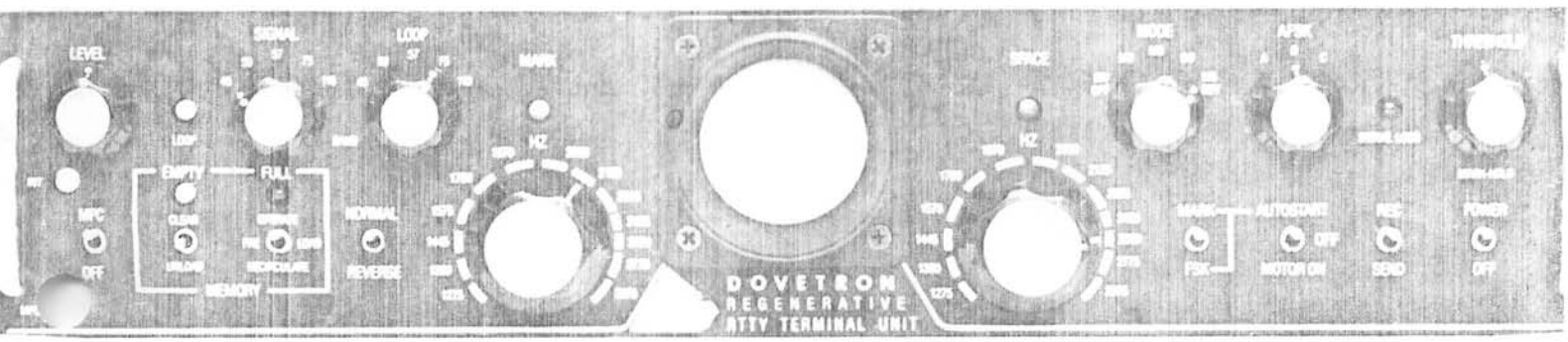
I-BAND DIVERSITY OPERATION (automatic mark-only or space-only)
NTINUOUSLY VARIABLE MARK and SPACE CHANNELS
200 to 3300 Hz.)
OISE COMBINING and CANCELLATION CIRCUITRY
NTEGRATED CIRCUIT ACTIVE FILTERS (no toroids)
PTIMUM BANDWIDTH FILTERS FOR 45 to 75 BAUD OPERATON
ED MARK and SPACE CHANNEL FILTER INDICATORS
HASE CONTINUOUS, SINE WAVE AFSK TONE GENERATOR
ONTINUOUSLY VARIABLE MARK and SPACE AFSK TONES
SK VOLTAGE LEVEL OUTPUTS (EIA RS232C and MIL STD 188C)
W ID PROVISIONS FOR AFSK and FSK OUTPUTS
ANUAL MARK-ONLY or SPACE-ONLY OPERATION
UTOMATIC MARK-HOLD, ANTI-SPACE and ANTI-CW
NTI MARK-FADE for SLOW SPEED OPERATION
DJUSTABLE INTERNAL 130 VOLT LOOP SUPPLY
ROVISIONS for EXTERNAL REGENERATION and DUAL DIVERSITY

MULTIPATH CORRECTOR™ CIRCUITRY
BUILT-IN 2 INCH CRT CROSS DISPLAY
MARK or FSK AUTOSTART
CRT DOT DEFLECTION CIRCUITRY
LED SIGNAL LOSS INDICATOR
LED LOOP KEYER INDICATOR
INTERNAL "RY" GENERATOR
INTERNAL TERMINAL UNIT SELF-TEST
VARIABLE THRESHOLD CONTROL
AUTOMATIC POWER SUPPLY PROTECTION
REMOTE CONTROL including LOCK ON TRANSM
TABLE TOP or RACK MOUNTING OPTION
110/220 VOLT, 50 to 400 Hz. OPERATION
SMALL SIZE, LIGHT WEIGHT, LOW COST



MPC-1000R REGENERATIVE

N-BAND DIVERSITY OPERATION (automatic mark-only or space-only)
ONTINUOUSLY VARIABLE MARK and SPACE CHANNELS (1200 to 3300 Hz.)
OISE COMBINING and CANCELLATION CIRCUITRY
NTEGRATED CIRCUIT ACTIVE FILTERS (no toroids)
PTIMUM BANDWIDTH FILTERS FOR 45 to 75 BAUD OPERATON
ED MARK and SPACE CHANNEL FILTER INDICATORS
HASE CONTINUOUS, SINE WAVE AFSK TONE GENERATOR
ONTINUOUSLY VARIABLE MARK and SPACE AFSK TONES
SK VOLTAGE LEVEL OUTPUTS (EIA RS232C and MIL STD 188C)
W ID PROVISIONS FOR AFSK and FSK OUTPUTS
ANUAL MARK-ONLY or SPACE-ONLY OPERATION
UTOMATIC MARK-HOLD, ANTI-SPACE and ANTI-CW
NTI MARK-FADE for SLOW SPEED OPERATION
DJUSTABLE INTERNAL 130 VOLT LOOP SUPPLY
ROVISIONS for EXTERNAL REGENERATION and DUAL DIVERSITY
MULTIPATH CORRECTOR™ CIRCUITRY
BUILT-IN 2 INCH CRT CROSS DISPLAY
MARK or FSK AUTOSTART
CRT DOT DEFLECTION CIRCUITRY
LED SIGNAL LOSS INDICATOR
LED LOOP KEYER INDICATOR
INTERNAL "RY" GENERATOR
INTERNAL TERMINAL UNIT SELF-TEST
VARIABLE THRESHOLD CONTROL
AUTOMATIC POWER SUPPLY PROTECTION
REMOTE CONTROL including LOCK ON TRANSM
TABLE TOP or RACK MOUNTING OPTION
110/220 VOLT, 50 to 400 Hz. OPERATION
SMALL SIZE, LIGHT WEIGHT, LOW COST



MPC-1000R REGENERATIVE

The **DOVETRON MPC-1000 MULTIPATH-DIVERSITY RTTY TERMINAL UNIT** is the amateur commercial version of a high performance militarized signal data converter designed to cope with the anamolies of HF multipath propagation.

Basically, the MPC-1000 consists of two identical low frequency solid state receivers, whose outputs drive a **MULTIPATH CORRECTOR™** circuit, which in turn, drives a high level keyer that outputs directly to a teleprinter.

Either receiver can be tuned to any mark or space tone between 1200 and 3300 Hz.

True In-Band **DIVERSITY** operation is achieved during selective fading since the **MULTIPATH CORRECTOR™** circuit will operate from single channel data as well. Either channel can be operator-inhibited for mark-only (MO) or space-only (SO) copy in the advent of heavy interference in either channel.

All filtering is accomplished with computer designed active filters utilizing integrated circuit op-amps. No toroids or matching transformers are required. A total of 43 identical linear **IC**s are used in the analog circuits. The **MULTIPATH CORRECTOR™** circuit consists of four identical digital C-Mos devices.

The coupling of the assessor circuits between the two receivers and the **MPC** circuitry permits error free copy with a continuous interferring tone in either channel.

No internal or external clocks are required for the **MPC**, since it is by design, a synchronous regenerator automatically operating at the same baud rate as the incoming signal.

The MPC-1000 itself is optimized for 45 to 75 baud operation.

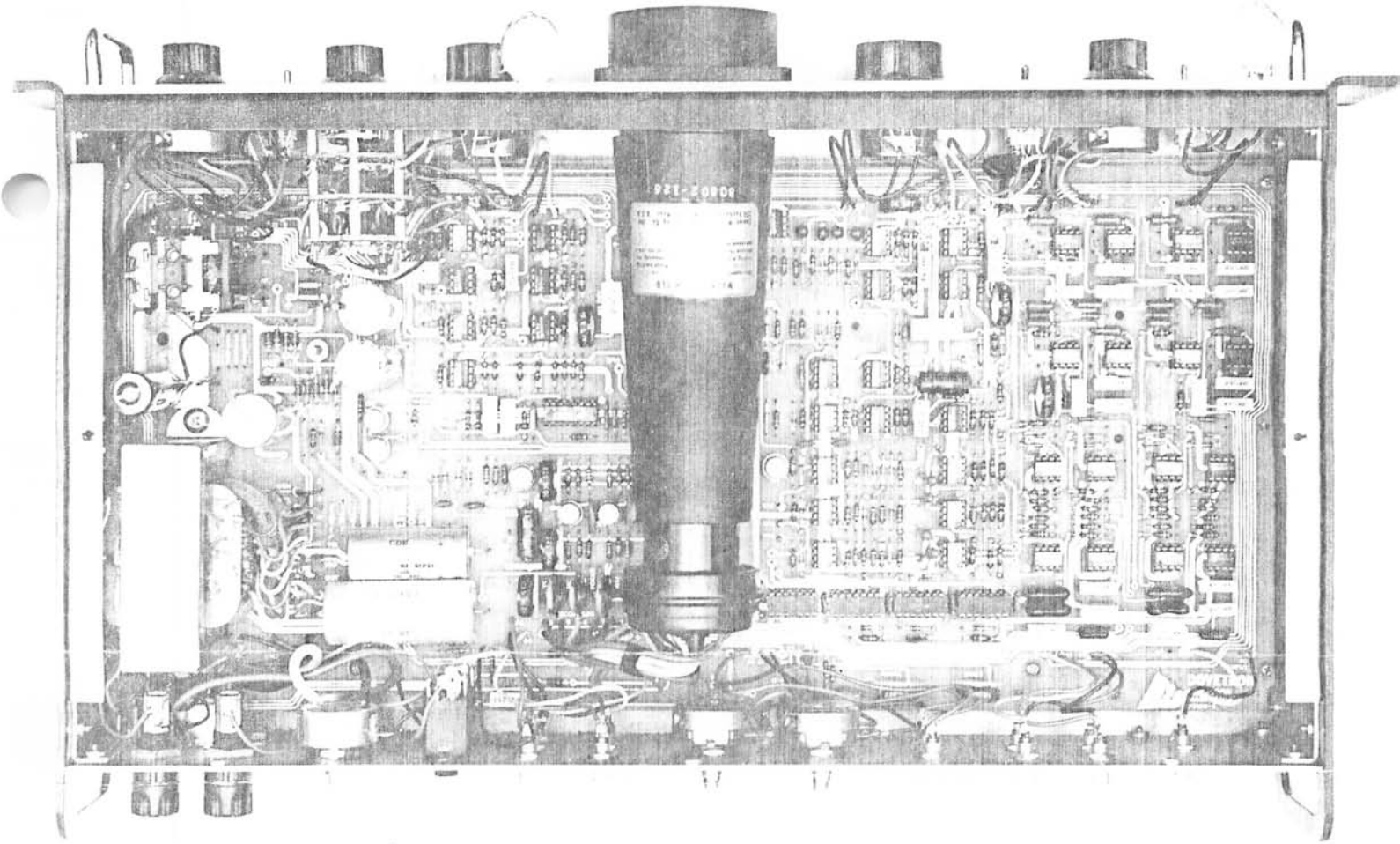
A dual autostart circuit permits operator selection of **MARK** or **FSK** autostart. In **MARK**, the teleprinter is turned on by a marking carrier and time-out is 20 seconds. This mode is useful for fast break-in and autostart net operations. The **FSK** mode autostarts upon receipt of a **RTTY** signal with mark-space transitions and times out in 60 seconds. This mode is intended for monitoring commercial stations that mark for long periods of time. Neither mode responds to a continuously spacing carrier.

In addition to the automatic **MARK-HOLD, ANTI-SPACE** and **ANTI-CW** functions, the **MPC-1000** also incorporates an anti-**MARK-FADE (AMF)** circuit, a **SIGNAL LOSS** circuit, a **RY** generator **(MS-REV)** mode and a 2" **CRT** cross display.

The **AMF** circuit prevents fast fades on the long marks of keyboard speed signals from initiating erroneous start pulses.

The **SIGNAL LOSS** circuit drives a front panel **LED** that indicates when the **TU** has gone to **MARK-HOLD** without a marking carrier. This information is also buffered to the rear panel for use as a system alarm or control signal. The **SIGNAL LOSS LED** is also a visual indication of the proper setting of the front panel **THRESHOLD** control under noisy or weak signal conditions.

A second front panel **LED** indicates the status of the loop keyer, and provides a visual indication that the high level loop and the **AFSK/FSK** outputs are being keyed by the **TU** during receive and by the keyboard during transmit.



Two additional front panel **LEDs** monitor the status of the two channel filters.

The **AFSK** tone generator is a 16-pin monolithic device that produces phase continuous, sine wave **AFSK** tones at a 150mv level at the rear panel. The mark and space tone frequencies are independently adjustable by rear panel lock-pots.

In the **MS-REV** mode, the **AFSK** tone generator is keyed by an internal square wave generator and the resultant mark-space tones are routed to the input of the **MPC-1000.** This provides a fast and accurate method of adjusting the mark and space tones, using the **CRT** cross display and the calibrated front panel **VFOs**. It also provides a rapid self-check of the entire terminal unit. When adjusted for the desired baud rate, the high level keyer, the **AFSK** generator and the **FSK** lines will output a continuous string of **RYs**, which can be used for circuit adjustment, machine maintenance and reinking, etc.

The internal 2" CRT provides a "thin" cross display as evidenced by the unretouched picture of the **MPC-1000** copying a string of **RYs** from the **AFSK** tone generator at 170 Hz. shift and 45.45 baud.

The channel separation and bandwidth characteristics of the channel filters as seen on the **CRT** is the same as presented by the filters to the following stages of the TU.

A dot deflection circuit prevents a CRT screen burn in the absence of a signal or noise, and is also used to display the slow flat fades of weak **RTTY** signals. Used in conjunction with the **SIGNAL LOSS** indicator and the **THRESHOLD** control, optimum threshold

Additional rear panel connectors make provision for use of an external scope, an external asynchronous regenerator, remote control of the transmitter and receiver from the **TU,** remote control of the **TU** from external switching, **CW ID** of both the **AFSK** and **FSK** outputs, and dual diversity (space, frequency and polarity) operation of two or more **MPC-1000** terminal units. The **DIV-OFF** mode permits normal operation of dual diversity pairs without disconnecting the interconnecting patch cables. One of the remote lines is a **LOCK** line, and when grounded externally, locks the teleprinter's motor on, puts the TU into Standby and locks the high level loop keyer, so only an external device can key the loop and the **AFSK/FSK** circuits.

The external **REGEN** connectors may be used for crypto, code conversion, regeneration or speed changing peripherals. The popular **Uart-FIFO** combinations interface without modification of their input and output circuits.

The high level loop output is available thru two insulated Nylon jacks. One is wired for a two way plug and the other for a stereo-type three way plug. Two way plugs may be used in either jack. The loop is fused at the rear panel with a 100 milliampere fuse. The loop adjustment potentiometer is adjustable over the range of 55 to 85 milliamperes into the standard 65 OHM teleprinter load.

The **MPC-1000** is normally supplied wired for 110 volt, 50 to 400 Hz. mains. A simple jumper change internally converts the unit for 220 volt operation. Package size is 17" wide, 3.5" high and 9" deep. Available in either

Two additional front panel **LEDs** monitor the status of the two channel filters.

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A dot deflection circuit prevents a CRT screen burn in the absence of a signal or noise, and is also used to display the slow flat fades of weak **RTTY** signals. Used in conjunction with the **SIGNAL LOSS** indicator and the **THRESHOLD** control, optimum threshold levels are easily set for copy of weak signals near the noise threshold.

Pressing the front panel **TEST** button allows the **CRT** to be used to adjust the 130 volt internal loop supply to 60 milliamperes.

Two **FSK** voltage level outputs are buffered to the rear panel and provide ±12 volts, **S/M (EIA RS232C)** and ±6 volts, M/S (Mil Std 188C). Since these outputs are inverted in respect to each other, the operator has the choice of either polarity for Mark to maintain right side up operation.

Additional rear panel connectors make provision for use of an external scope, an external asynchronous regenerator, remote control of the transmitter and receiver from the **TU**, remote control of the **TU** from external switching, **CW ID** of both the **AFSK** and **FSK** outputs, and dual diversity (space, frequency and polarity) operation of two or more **MPC-1000** terminal units. The **DIV-OFF** mode permits normal operation of dual diversity pairs without disconnecting the interconnecting patch cables. One of the remote lines is a **LOCK** line, and when grounded externally, locks the teleprinter's motor on, puts the TU into Standby and locks the high level loop keyer, so only an external device can key the loop and the **AFSK/FSK** circuits.

The external **REGEN** connectors may be used for crypto, code conversion, regeneration or speed changing peripherals. The popular **Uart-FIFO** combinations interface without modification of their input and output circuits.

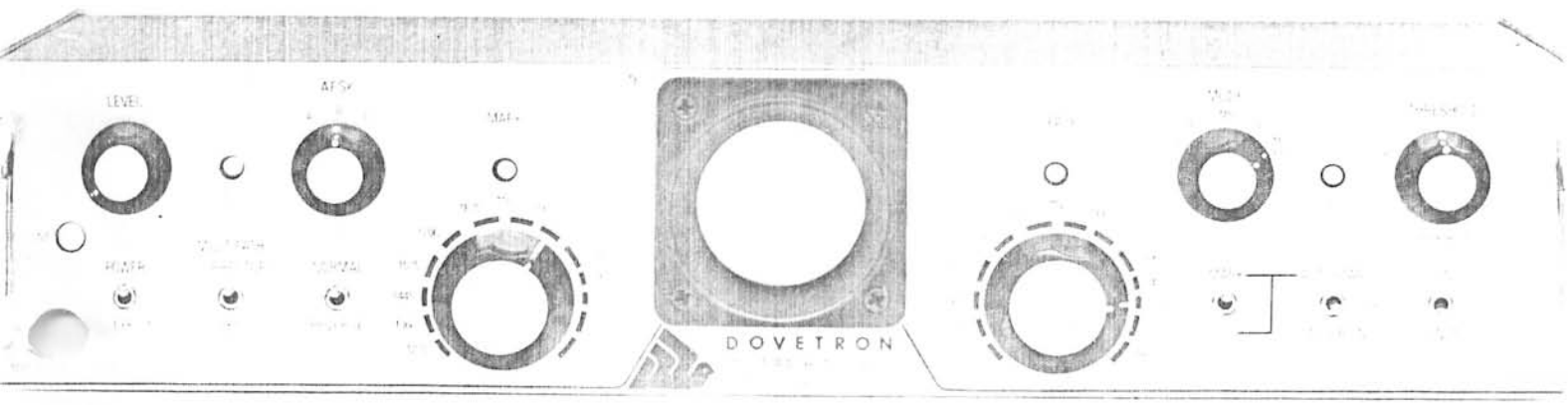
The high level loop output is available thru two insulated Nylon jacks. One is wired for a two way plug and the other for a stereo-type three way plug. Two way plugs may be used in either jack. The loop is fused at the rear panel with a 100 milliampere fuse. The loop adjustment potentiometer is adjustable over the range of 55 to 85 milliamperes into the standard 65 OHM teleprinter load.

The **MPC-1000** is normally supplied wired for 110 volt, 50 to 400 Hz. mains. A simple jumper change internally converts the unit for 220 volt operation. Package size is 17" wide, 3.5" high and 9" deep. Available in either a table top package or for standard 19" rackmount (please specify at time of order), net weight is 11 pounds. Packed for shipping, weight is 15 pounds.

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

DOVETRON

DOVETRON P. O. BOX 267
627 Fremont Avenue
South Pasadena, Calif. 91030
213-682-3705



MPC-1000CR & MPC-1000CR/DK

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
ALL	E	REWORK PER ENG. EVALUATION MT.	3/8/76	

CR8 & CR9 MOUNTED ON FARSIDE OF PCBOARD

FOR MPC1000C & MPC-1000R INSTALL .056 uf C4 & C5)

T1
7827B
WOOD TRANS. ORANGE, CA.

T2
AR-187
OZ
TY-34X

2API
SCOPE
2AP1A

MOUNT FARSIDE

SLEEVED JUMPER

NOTE: T2 USED ONLY ON MODEL MPC1000C/MPC1000R

SCOPE LEADS		COLOR CODE	
2API - 2APA		2API/2BP1A/2BP1	
1 BRN	7 VI	1 BRN	7 GREY
2 RED	8 GRY	2 ORN	8 WHT
3 ORN	9 WT	3 BLK	9 BLUE
4 YEL	10 BK	4 YEL	10 RED
6 BLUE	11 WBRN	5 VIO	11 WBL

⚠2 **FINISH** (IF APPLICABLE)
MF = 1% 1/4W METAL FILM RN55D
☆ = FEED THRU HOLES ONLY
✳ = THESE COMPONETS NOT USED IN STD UNIT.
⚠1 **MATL** (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

	1		MPC 1000C	150 ¢ ON	3/8/76	E
	1		MPC 1000	100 ¢ ON	11/17/75	D
	1		MPC 1000R	0 ¢ ON	7/22/75	C
	1			1 THRU 5	2/1/75	—
DASH NO.	NEXT ASSY USED ON		SERIAL NO.	DATE EFF	DWG REV	
	APPLICATION		EFFECTIVITY			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.013 THRU .038 +.004 −.001
.331 THRU .500 +.004 −.001
.174 THRU .330 +.003 −.001
.501 THRU .750 +.006 −.001
MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY		
DESIGN	DESIGN FOUR MT	
DRAFTED	DRAFTING FOUR 3/18/76	
CHECKED	DESIGN FOUR MT	
APPROV	"E" 4-22-76	
RELEASE	10-4-76	
DO NOT SCALE DWG		

DOVETRON
50. PASADENA, CALIFORNIA

TITLE: PRINTED CIRCUIT BD ASS'Y — CONTROL BOARD — MODEL MPC1000 & MPC1000C&R

SIZE	CODE IDENT		
D		75100	E

SCALE 2:1 — 1 OF 1