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

INSTALLATION INSTRUCTIONS

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TSR-200 to E-Series Dovetron MPC-1000(C)

Install the two bolts with a nylon washer between the bolt-head and the bottom of the main board. Snip off any long component leads that might short to the head of the bolts. Slip on the nylon standoffs and lightly secure in place with the locking nuts.

The TSR-200 may be set on top of the locking nuts to give you a better idea of the cable routing requirements. Do not mount the TSR-200 in the TU until all the wires have been installed.

The following installation instructions pertain only to E-Series terminal units. Check the main board number on the bottom side of the TU. It should be A75100-E.

TSR-200 CONFIGURATION

The TSR-200 is manufactured in two different configurations depending whether it is to be used in the B/C or D/E Series Dovetrons.

Check the TSR-200 board and verify that ~~R29~~ R27 near J1 socket is 200 ohms (not 2000 ohms) and that R40A (10K) is installed and that R40B is not installed.

CR6 is a bypass capacitor for the-V line and is not normally used when the TSR-200 is installed in any Dovetron terminal unit.

TU MODIFICATION

1) Remove the jumper wire installed between REGEN IN and REGEN OUT.
2) Remove the jumper wire installed between EIA and AFSK INPUT.

These jumpers are normally red, and their removal completes modification of the MPC-1000(C) E-Series terminal unit prior to installation of the TSR-200.

CABLE INSTALLATION

The Power/Logic cable is terminated with a 14 pin connector and has 14 wires in the cable. Do not confuse it with the Speed Cable that has a 16 pin connector and only 8 wires.

Dress the Power/Logic cable along the rear of the terminal unit in such a way that the 14 pin connector will easily plug into the 14 pin socket on the TSR-200 at the left rear. Trim and connect the following wires as directed: (See Schematic, the following assumes no front panel "Regen" switch).

1) Connect J1-2 (Red-Ground) to E-50 directly below the terminal unit's Audio Input connector.
2) Connect J1-4 (Yellow-EIA FSK) to the rear panel EIA FSK connector.
3) Connect J1-1 (Brown-AFSK KEYER) to the rear panel AFSK INPUT connector.
4) Connect J1-7 (Violet-DATA INPUT) to the rear panel REGEN OUT connector.