

INSTRUCTION MANUAL

DOVETRON MPC-1000C

MULTIPATH-DIVERSITY RTTY TERMINAL UNIT

E - SERIES

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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 Bessel 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 CORRECTORTM 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 CORRECTORTM to function properly, it was necessary to demodulate the Mark and Space channels without adding any significant perturbations. 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 600 Ω input matching transformer and should be driven by a 500 to 600 Ω 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 600 Ω 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 CORRECTORTM 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-CORRECTORTM circuit is an asynchronous 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: 600 Ω , 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, 1K Ω output Z. Mark: -12vdc. Space: +12vdc.

MIL-STD-188C FSK voltage levels, 1K Ω output Z. Mark: +6vdc. Space: -6vdc.

Phase continuous, sine-wave AFSK tone generator. Output level: 60 millivolts with 470 Ω 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 CORRECTORTM 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 Bessel Function design provides a "flysheel" action that aids in overcoming the error-producing perturbations 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 circuits 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 600 Ω 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 5K Ω 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 (Bessel 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 to 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 CORRECTORTM 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 CORRECTORTM 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 CORRECTORTM circuit and are available at TP4 and TP5.

MULTIPATH CORRECTOR CIRCUIT

The MULTIPATH CORRECTORTM (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 50,000 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 $2K\Omega$ to the base of the high level loop keyer, Q7. This impedance consists of two $1K\Omega$ 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 $1K\Omega$ 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: $1K\Omega$.

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

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 KEYS

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.

