# 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

## 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.

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# DOVETRON

MPC-1000R MARK II

The latest addition to the Dovetron E-Series is the MARK II version of the ubiquitous MPC-1000R Regenerative RTTY Terminal Unit.

The MARK II is the logical combination of the MPC-1000R and the BBP-100 Binary Bit Processor.

The BBP-100 provides three functions:

1) High performance axis restoration,
2) Selectable Bandwidth, and
3) Hysterisis Multipath Correction.

The combination of these three functions permit operation very close to the theoretical error-rate curve.

Axis restoration is accomplished with a "track and hold" logic circuit that permits accurate zero-crossing determinations on very weak and poor quality signals.

The selectable bandwidth feature permits optimization of the SNR of the terminal unit to the baud rate of the incoming signal.

A three position front panel switch permits operator selection of one of three active bandwidth modules on the BBP-100 assembly. Two additional bandwidth modules are stored in passive sockets.

The active bandwidths are 45.45, 50.0 and 74.2/75.0 baud. The passive bandwidths are 56.88 and 110 Baud. Other bandwidth combinations are available on request.

The design of the bandwidth switching circuit is such that a new bandwidth may be selected during signal reception without introducing errors from switching transients or circuit response time.

The hysterisis-controlled Multipath Corrector circuit is fully automatic and corrects for bias distortion created by time/frequency dispersive multipath distortion.

In addition to the inclusion of the BBP-100, the front panel Mark and Space VFOs have been extended in range to include the commercial tone pair 1070 Hz - 1270 Hz.

A fifth position (marked SBR) on the Signal Speed Select switch normally selects the proper clock frequency for 110 baud (100 WPM) ASCII operation. When an SBR-100 Selectable Baud Rate module is installed on the TSR-500D board, a preset "privacy" Baudot baud rate may be selected. The SBR-100 also permits other than 110 baud ASCII operation.

The original DIGITAL position of the Autostart Select switch has been re-labeled SCL-DAS and provides control of the SCL-100 Selective Calling option and/or the DAS-100 Digital Autostart module.

A 115/230 VAC mains select switch is mounted internally at the rear panel for rapid mains interface.

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# DOVETRON

MPC-1000R MARK II ADDENDUM December 1979

The MPC-1000R Mark II RTTY Terminal Unit contains a factory-installed BBP-100 Binary Bit Processor. This device provides front panel selectable bandwidth, a new method of axis restoration and a hysteresis mode of Multipath Correction.

Unless indicated differently on the tag on the top cover of the terminal unit, the three bandwidth positions are:

WIDE: 75.0 Baud, 100 WPM.

MEDIUM: 50.0 Baud, 66 WPM.

NARROW: 45.45 Baud, 60 WPM.

Two extra bandwidth modules are plugged into storage sockets at the left rear of the BBP-100 assembly: 57 Baud and 110 Baud.

The frequency range of the front panel VFOs has been expanded downward to 1000 Hz, permitting the use of 1275 Hz as a center frequency for a ±42.5 and ±85 Hz shift scheme. The landline modem tone frequencies of 1070 Hz and 1270 Hz are also tuneable.

The front panel photocell for CRT intensity control is omitted in the Mark II and the photocell that controls the intensity of the solid state cross display is mounted in the lower left quadrant of the SSD-100 display.

If equipped with a KOS-100 Keyboard Operated Send assembly, a Mark II KOS-100 board is installed. This Mark II version of the KOS permits the use of either a positive or a negative PTT circuit.

Since this KOS-PTT circuit will function with either polarity, it may also be used with current-limited (100 milliamperes maximum) AC circuits.

If equipped with a TID-100 Station Identifier, a Mark II version of the TID-100 is installed.

The new Mark II TID-100 shifts the keyed Mark tone downward, away from the Space tone channel. R8 (47K) determines the amount of downward shift and may be changed by individual operators to suit their own preference.

If upward shift (toward the Space channel) is preferred, move the blue wire connected to KOS E-Point 56 to KOS E-Point C at the middle (rear edge) of the KOS-100 assembly.

The Mark II DAS-100 Digital Autostart Module is AC coupled, which prevents a Space Character left in the output register of the UART from locking-on the Autostart relay.

The Mark II SSD-100 Solid State Cross Display module contains four plug-in 10 segment bargraph display modules.

The Mark II MPC-1000R also contains a 115/230 VAC power mains select switch, which is mounted internally on the rear panel.

**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 TSR-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.

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**DOVETRON** ADDITIONAL FEATURES - E-Series

The latest E-Series represents six years of development and refinement and include the following additional features:

SOLID STATE CROSS DISPLAY The SSD-100 Display consists of a plug-in module with a cross pattern of light emitting diodes. Additional LEDs in three quadrants of the cross display indicate Multipath Distortion, loop current and Signal Loss. A photocell in the fourth quadrant automatically controls the light intensity of the display.

AUTOMATIC THRESHOLD LEVEL Upon acquisition of an incoming signal, an electronic tracking circuit sets the threshold level of the terminal unit, 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, turning on the local teleprinter's motor and permitting retrieval of messages left in the typing unit during unattended operation.

AUTOSTART DELAYED TIMEOUT FSK Autostart time-out is automatically inhibited during data entry and provides a 20 second time-out period after the last character is sent, providing adequate time for station identification procedures.

INPUT AMPLIFIER PROTECTION High speed diodes protect against high voltage transients generated by external audio switching circuits and comm-center patch panels.

TONE KEYER OUTPUT A Ø dbm transformer-coupled AFSK output option is available on special order (Standard in C/DK and CR/DK units).

ADJUSTABLE HIGH LEVEL NEUTRAL LOOP Internal strapping provides either 40/60 or 20 mil 120 VDC neutral loop operation.

POLAR KEYER OPTIONS The DK series offers both Polar and Neutral high level keyers. Polar voltages are ±48, ±50, ±60 and ±80. Polar currents available are 20, 40 or 60 mils. Other levels are available on special order. The PKC-100 Polar Keyer option provides high level polar keying in the C and R Series.

GOLD PLATED SOCKETS All integrated circuits and transistors are socket mounted in side wipe sockets for ease of maintenance and service.

KEYBOARD OPERATED SEND The KOS-100 option permits Send/Receive control of the terminal unit and peripheral transmitters and receivers from the keyboard of the local teleprinter.

SELECTIVE CALLING The SCL-100 Sel-Cal option may be plugged into the TSR-500D and provides four character turn-on and turn-off of local teleprinter.

DIGITAL AUTOSTART The DAS-100 Digital Autostart option provides a character recognition, speed determining form of autostart that is not actuated by non-RTTY interfering signals.

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