



# WJ-9040 MRU109 MODULATION RECOGNIZER



### DESCRIPTION

The MRU109 is a WJ-9040 system-compatible modulation recognition unit designed to work in conjunction with HF and VHF/UHF receivers. The MRU109 has been designed primarily to recognize AM, NBFM, CW, and OOK signals. Limited recognition of SSB, FSK, and NOISE is also provided.

The unit does not demodulate the signal but instead uses digital signal processing techniques to generate an approximation of the amplitude and frequency characteristics of the applied input signal. A pattern-matching algorithm is then activated. If a match is found, the modulation type is indicated by the appropriate front panel LED and is

simultaneously made available to the system interface. If no match is found or no signal is present, an LED is activated to indicate either UNKNOWN or NO SIGNAL as appropriate.

Provisions have been incorporated to permit either local or remote control. For local operation, two front panel pushbuttons allow for selection of either the 21.4 MHz or 455 kHz IF input and initiation of a modulation recognition cut. Results of the recognition process are indicated by lighting of a front panel LED. The same control and status information is available remotely through the WJ-9040 system remote interface options.

## SPECIFICATIONS

Input Frequency .....	21.4 MHz or 455 kHz
Input Bandwidth .....	3 kHz to 20 kHz
Input Impedance .....	50 ohms nominal
Input Level .....	455 kHz at -20 dBm $\pm$ 2 dB 21.4 MHz at -10, -15, -20, or -30 dBm $\pm$ 2 dB

### Recognizable Modulation Types and Conditions

AM .....	Speech modulation from 300 Hz to 3.2 kHz. Modulation percentages from 30 to 90
NBFM .....	Speech modulation from 300 Hz to 3.2 kHz. Deviation from 500 Hz to 7.5 kHz
OOK .....	Random asynchronous data at 5 to 100 baud. On/off ratio of 30 dB or greater (approximately 5 to 100 WPM)
CW .....	Unmodulated sinewave with a duration of 1 second or greater
SSB .....	Speech-modulated upper or lower sideband with a bandwidth of 3.2 kHz or less. Carrier and unwanted sideband suppressed by 25 dB or more
FSK .....	Data at 60 to 6400 baud, 800 Hz to 15 kHz peak-to-peak
NOISE .....	Gaussian noise 20 dB or more above receiver noise floor, bandwidth of 10 to 20 kHz

### Identification Accuracy

Input SNR of 20 dB or more .....

Modulation Type	Probability Correct
AM	85%
NBFM	85%
OOK	80%
CW	85%
SSB	65%
FSK	75%
NOISE	75%

**Note:** The above table lists typical performance and assumes that the IF input level is nominal, that the receiver settings, such as AGC and IF bandwidth, are appropriate for the signal type, and that the signal is reasonably close to being centered in the passband (preventing, for example, FM signals from deviating outside of, or onto, the skirts of the IF filter). Performance may vary if this is not the case. Also, performance is specified for typical signals of each type; some individual signals may have unusual characteristics (such as extreme phase noise or overmodulation on an AM signal) that will cause degradation of these percentages.

Identification Speed .....	4 seconds maximum, 2 seconds typical
Remote Control Options .....	RS-232 or IEEE-488 interface through the WJ-9040 IOM108
Remote Commands (ASCII Format) .....	MOD? Returns modulation type IF? Returns selected IF IF1 Selects the 21.4 MHz input IF2 Selects the 455 kHz input CUT Initiates recognition cut
Front Panel Controls .....	21.4 IF FREQ — IF input select at 21.4 MHz (LED on) or 455 kHz (LED off) MOD RECOG CUT — Initiates a modulation recognition cut
Required Inputs .....	J1 25-pin type D male connector $\pm$ 18.2 VDC and $\pm$ 8.3 VDC from a WJ-9040 EPS100 power supply or equivalent. Serial I/O from a WJ-9040 IOM108 or equivalent if remote control is desired
Power Consumption .....	8 watts maximum
Operating Temperature .....	0 to 50 °C
Dimensions .....	5.2 inches high, 2.0 inches wide, 14.38 inches deep
Weight .....	6 lbs., approximately

### Operational Notes

1. For best operation against OOK and SSB, the receiver should be set to the slow AGC mode; for all other modulation types, the fast AGC setting should be used. Manual gain should not be used.
2. For best results, the receiver should be set to a bandwidth wide enough to pass the entire signal of interest and only the signal of interest.