

DUAL FSK MODEM

USERS MANUAL
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GENERAL DESCRIPTION

1.1 INTRODUCTION

This Manual details the information necessary for set-up and operation of the MARC™ Dual Modem board for the Allen-Bradley Programmable Logic Controller (PLC). The modem board is MARC Part Number 148-001

The 148-001 Modem contains two completely independent FSK modems in a single Allen-Bradley 1771 compatible module. Optionally, the two modems can be operated in a redundant mode which permits two analog channels to be used with a single RS232 port. Both modem channels are identical Asynchronous Frequency Shift Keying (FSK) voiceband modems intended for use in leased line applications. The Modems can be used in either 2-Wire or 4-Wire configurations. They are independently switch selectable for operating mode. The modems are compatible with the applicable Bell and CCITT recommended standards for 103/13/108, 202, V.21 and V.23 type modems.

The transmit signal level from each modem is switch selectable by the user from +2 to -12 dbm for added versatility.

The interface signal levels to each modem conform to the RS232-C standard. Two 15-pin "D" type connectors located on the front of the module are used to connect to the communications device. Two standard RJ11 telephone line connectors are also located on the front panel of the Modem for easy connection to the communication lines

The Modem card obtains +5VDC power from the PLC backplane connector. No other connections to the backplane are made.

SPECIFICATIONS

Physical:

- Requires one module slot in an Allen-Bradley 1771 I/O chassis
- 1.1" W X 10" H X 5.75" D (standard Allen-Bradley module size)
- 2 pound, 4 ounces

I/O Connections:

- 2 15-Pin "D" Connectors (DE15S) for RS-232 Interfaces
- 2 RJ-11 Connectors for Communication Lines

Compatibility (each channel individually selected):

- Bell 103/113/108
- Bell 202
- CCITT V.21
- CCITT V.23

User Selectable Options:

- Optional Soft Carrier Turn Off on V.23 Modes
- Full or Half Duplex Operation
- Switch Selectable Operating Mode
- Switch Selectable Transmit Level
- Switch Selectable Redundant Operating Mode

Backplane Power Supply Load:

- 950 ma from 5 VDC

Operating Environment:

- 0 to 60 Degrees C
- Relative Humidity 10 to 90% (non-condensing)

INTERFACE CONNECTIONS

3.1 RS-232C CONNECTOR

Connections to the Comm-Troller or other devices with RS-232C compatible communication ports are made via connector P1 or P2 depending on the channel to be used. Connector P1 is used with modem channel A and as the redundant channel connection. Connector P2 is used with modem channel B. Both connectors are 15-pin "D" connectors with identical pinouts. Figure 1 details the interface connector pin assignments.

PIN	FUNCTION
1	Ground Reference
2	Transmit Data (TXD) (input)
3	Receive Data (RXD) (output)
4	RTS Request To Send (input)
5	CTS Clear To Send (output)
6	+ 12V
7	Ground Reference
8	DCD Data Carrier Detect (output)
11	DTR Data Terminal Ready (input)
all other pins are not connected	

●Figure 1 Interface Signals

3.1.1 Pin 2 Transmit Data

Data to be transmitted onto the phone lines is presented on pin 2. The input signal levels are standard RS-232 voltage levels. A low input on this line (negative voltage) will result in a "MARK" tone on the line. A high input on this line (positive voltage) will result in a "SPACE" tone on the line.

3.1.2 Pin 3 Receive Data

Data received from the phone line and decoded by the modem is present on pin 3. The signals on this line are equivalent to those on pin 2. That is, a "MARK" tone on the line will be indicated by a negative output and a "SPACE" tone by a positive output.

3.1.3 Pin 4 Request To Send

A high level on this input instructs the modem to enter the Transmit Mode. This input must remain high for the duration of data transmission. A low level on this input disables the transmitter. The state of this input has no effect if Data Terminal Ready* input is low.

3.1.4 Pin 5 Clear To Send

The Clear To Send (CTS) output goes high at the end of a delay initiated when Request To Send (RTS) goes high. Actual data to be transmitted should not be presented to the transmitted data input until a high is indicated on the Clear To Send output. Normally the user should force the transmitted data input low whenever Clear To Send is off (low). This signal never goes high as long as Data Terminal Ready is low (disabled). Clear To Send goes low at the end of a delay initiated when Request To Send goes low. Values for t_{RCON} and t_{RCOFF} are configuration dependent and are listed in Figure 4.

3.1.5 Pin 6 +12V

Pin 6 provides a convenient connection point for a high RS232 voltage level. This may be required for special interface connections where some signals are to be permanently strapped to a true condition. One application for example might be a test connector which would connect Pin 6 to the RTS input, Pin 4. If RTS is set to a true condition then a continuous tone (either a mark or a space depending on the state of Pin 2) will be output on the phone line. This might be useful in some troubleshooting applications. Pin 6 is current limited by a 10K Ohm resistor.

3.1.6 Pin 1 and 7 Ground Reference

Pins 1 and 7 provide a ground reference for the RS-232 voltage levels.

3.1.7 Pin 8 Data Carrier Detect

A high level ($>3V$) on the data carrier detect output indicates that a valid carrier signal is present at the receiver and has been present for at least a time t_{CDON} , where t_{CDON} depends upon the selected modem configuration. A low on this output ($<-3V$) signifies that no valid carrier is being received and has not been received for a time, t_{CDOFF} . Data Carrier Detect remains low when Data Terminal Ready is low. Values for t_{RCON} and t_{RCOFF} are configuration dependent and are listed in Figure 4.

3.1.8 Pin 11 Data Terminal Ready

A high level on this input indicates that the data terminal desires to send and/or receive data via the modem. This signal is gated with all other inputs and outputs so that a high level enables all these signals as well as the internal control logic. A low level disables all TTL I/O pins and the internal modem logic.

3.2 ANALOG SIGNAL CONNECTION

The telephone line connections are made at connector P3 and P4. Connector P3 is connected to modem channel A; Connector P4 is connected to modem channel B. Both connectors are standard RJ-11 modular jacks that are commonly found on many telephone lines. This connector provides the 4-wire connection required. Two line coupling transformers per channel are provided on the modem board for direct connection to the transmit and receive wire pairs in leased line applications. The line coupling transformers each provide an isolated 600 Ohm line connection. The transformers are designed to meet FCC Part 68 requirements for telephone line connections. The transmit pair (output from the Modem) is on pins 3 and 4 of the RJ-11 connector. This is normally the red/green pair of a standard modular connector. The receive pair (input to the Modem) is on pins 2 and 5 of the modular connector. The receive pair is normally the yellow/black pair. Pins 1 and 6 on the connector are not used.

MODEM OPERATING MODE SELECTION

MODEM OPERATING MODE SELECTION

4.1 OPERATING MODE SELECTION SWITCH

The desired mode of operation is selected by setting the switches on switch SW1 and SW3 as defined in the following Figure. SW1 is used to select the operating mode of modem channel A and SW3 is used to select the mode of modem channel B.

1	2	3	4	5	6	7	8	OPERATING MODE
1	1	1	1	1	X	X	X	Bell 103 Originate 300bps full duplex
1	1	1	1	0	X	X	X	Bell 103 Answer 300bps full duplex
1	1	1	0	1	X	X	X	Bell 202 1200bps half duplex
1	1	1	0	0	X	X	X	Bell 202 1200bps half duplex w/equalizer
1	1	0	1	1	X	X	X	CCITT V.21 Originate 300bps full duplex
1	1	0	1	0	X	X	X	CCITT V.21 Answer 300bps full duplex
1	1	0	0	1	X	X	X	CCITT V.23 Mode 2 1200bps half duplex
1	1	0	0	0	X	X	X	CCITT V.23 Mode 2 1200bps half duplex w/equalizer
1	0	1	1	1	X	X	X	CCITT V.23 Mode 1 600bps half duplex
1	0	0	1	1	X	X	X	CCITT V.23 Mode 1 600bps w/soft turn off
1	0	0	0	1	X	X	X	CCITT V.23 Mode 2 1200bps w/soft turn off
1	0	0	0	0	X	X	X	CCITT V.23 Mode 2 1200bps w/equalizer and soft turn off
0	1	1	0	1	X	X	X	Bell 202 1200bps full duplex
0	1	1	0	0	X	X	X	Bell 202 1200bps full duplex w/equalizer
0	1	0	0	1	X	X	X	CCITT V.23 Mode 2 1200bps full duplex
0	1	0	0	0	X	X	X	CCITT V.23 Mode 2 1200 bps full duplex w/equalizer
0	0	1	1	1	X	X	X	CCITT V.23 Mode 1 600bps full duplex

X = Not Used, 0 = Switch OFF, 1 = Switch ON

•Figure 2 Option Switch Settings

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MODEM OPERATING MODE SELECTION

4.1.1 Frequency Parameters

Selection of the operating mode automatically determines the frequency parameters which will be used in communication. Figure 3 details the frequency parameters for each mode.

MODE	TRANSMIT FREQUENCY		RECEIVE FREQUENCY		SOFT TURN OFF TONE
	SPACE	MARK	SPACE	MARK	
Bell 103 Orig	1070	1270	2025	2225	
Bell 103 Ans	2025	2225	1070	1270	
CCITT V.21 Orig	1180	980	1850	1650	
CCITT V.21 Ans	1850	1650	1180	980	
CCITT V.23 Mode 1	1700	1300	1700	1300	900
CCITT V.23 Mode 2	2100	1300	2100	1300	900
Bell 202	2200	1200	2200	1200	900

•Figure 3 Modem Frequency Parameters

4.1.2 Timing Parameters

Selection of the operating mode automatically determines the modem timing parameters which will be in use. Figure 4 details the timing parameters for each operating mode.

DUAL FSK MODEM

MODEM OPERATING MODE SELECTION

	t_{RCON} ms	t_{RCOFF} ms	t_{CDON} ms	t_{CDOFF} ms	t_{SQ} ms	t_{STO} ms
Bell 103 Orig	25.0	0.52	9-20	4-23	-	-
Bell 103 Ans	25.0	0.52	9-20	4-23	-	-
CCITT V.21 Orig	25.0	0.52	10-20	10-20		
CCITT V.21 Ans	25.0	0.52	10-20	10-20	-	-
CCITT V.23 Mode 1	8.0	0.52	3-7	3.4-11.3	9.0	8.0
CCITT V.23 Mode 2	8.0	0.52	3-7	3.4-11.3	9.0	8.0
Bell 202	8.0	0.52	3-7	3.4-11.3	9.0	8.0

•Figure 4 Modem Timing Parameters

4.2 TRANSMIT LEVEL SELECTION

The transmit level is determined by setting the desired switch position on SW2 for modem channel A or SW4 for modem channel B to the ON position. The Transmit levels are clearly marked near each switch. Only one switch position should be in the ON position. Transmit levels can be set in 2 db increments from -12 to +2 db.

4.3 REDUNDANT OPERATION

The Redundant mode of operation is selected by setting SW1 position 6 to the ON position. If SW1 position 6 is in the ON position then either modem channel A or modem channel B will be connected to connector P1. The DTR interface signal is used to select the active modem channel. If the DTR line is high then modem channel B will be active, if the DTR line is low then modem channel A will be active.

4.4 LED INDICATORS

The Dual Modem has several LED indicators which are visible from the front of the module. The indicators are a visual aid for monitoring the operation of the modem and for troubleshooting when problems occur. The LED functions are clearly marked on the module case. The following paragraphs further detail the function of each LED.

4.4.1 REDUNDANT MODE (LED 2)

The Redundant LED echos the current mode selection as determined by SW1 position 6. If the LED is ON then the modem is operating in its Redundant mode. If the LED is OFF then each of the two modems is operating independently

4.4.2 CLEAR TO SEND CHANNEL A (LED 3)

This LED indicates the current state of the Clear to Send (CTS) line on connector P1 (channel A). If the CTS line is high (active) the LED will be ON. If the line is low the LED will be OFF. Note that if the modem is operating in the redundant mode and modem B is the active modem then LED 3 will be the same as LED 7 (CTS Channel B).

4.4.3 TRANSMIT DATA CHANNEL A (LED 4)

This LED indicates the current state of the Transmit Data (TXD) line on connector P1 (channel A). If the TXD line is high the LED will be ON. If the line is low the LED will be OFF. Note that if the modem is operating in the redundant mode and modem B is the active modem then LED 4 will be the same as LED 8 (TXD Channel B).

4.4.4 DATA CARRIER DETECT CHANNEL A (LED 5)

LED 5 indicates the current state of the Data Carrier Detect (DCD) line on connector P1 (channel A). If DCD is high (active) the LED will be ON; if low the LED will be OFF. If the modem is operating in the redundant mode and modem B is the active modem then LED 5 will be the same as LED 9 (DCD Channel B).

4.4.5 RECEIVE DATA CHANNEL A (LED 6)

The current state of the Receive Data (RXD) line on connector P1 (channel A) is shown by LED 6. If the RXD line is high the LED will be ON. If the line is low the LED will be OFF. If the modem is operating in the redundant mode and modem B is the active modem then LED 6 will be the same as LED 10 (RXD Channel B).

4.4.6 CLEAR TO SEND CHANNEL B (LED 7)

LED 7 indicates the current state of the Clear to Send (CTS) line on channel B. If the CTS line is high (active) the LED will be ON; if low the LED will be OFF.

4.4.7 TRANSMIT DATA CHANNEL B (LED 8)

This LED indicates the current state of the Transmit Data (TXD) line on connector P2 (channel B). If the TXD line is high the LED will be ON. If the line is low the LED will be OFF.

4.4.8 DATA CARRIER DETECT CHANNEL B (LED 9)

This LED indicates the current state of the Data Carrier Detect (DCD) line on connector P2 (channel B). If the DCD line is high (active) the LED will be ON. If the line is low the LED will be OFF.

4.4.9 RECEIVE DATA CHANNEL B (LED 10)

This LED indicates the current state of the Receive Data (RXD) line on connector P2 (channel B). If the RXD line is high the LED will be ON. If the line is low the LED will be OFF.