# Multi-Drop Peripheral Interface

FEATURES

- Interface a third-party RS-232 peripheral with the stackable data module's multi-drop bus.

- DIP switch addressable; stack up to 32 modules (hence peripherals) on the same RS-232 cable connected to a host PC.

- Appended header character allows host to communicate exclusively with each device.

- Supports peripheral baud rates of 150, 300, 600, 1200, 1800, 2400, 4800 and 9600.

- 160-byte RAM buffer used for data transfers.

- Supplies power to peripheral via DTR pin.

- Industry standard RS-232 interfaces used to connect to host and slave modules. Meets all EIA/TIA-232E and V.28 specifications.

- Wide power supply range (8 to 30 VDC).

DESCRIPTION

Connects to the RS-232 serial port of a computer peripheral such as a bar-code scanner, weight scale, force-gauge, multi-meter, etc., and allows multiple devices to share the same communications cable connected to a PC. A unique header character is automatically appended to the beginning of a peripheral's data stream as it is being transmitted to the host, identifying its origin. This same header character is used by the host to direct data to a particular peripheral.

All data from a peripheral is converted to the correct baud rate used in the stackable data module network, and vice versa. In other words, it is possible to have multiple devices plugged into the same port of a PC even though they are all using a different baud rate for communications. Ideal for low cost, fast setup, assembly line monitoring using off-the-shelf PC hardware.
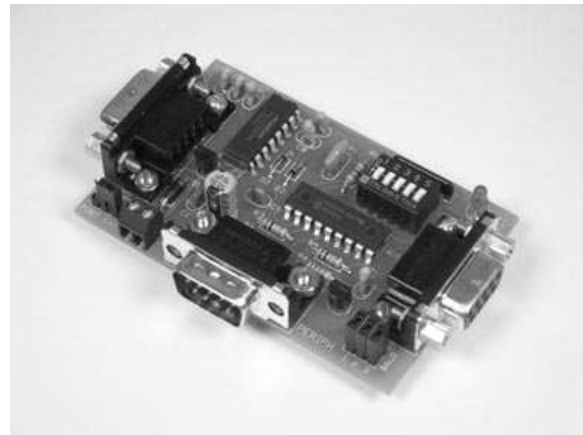
SPECIFICATIONS

Message Length	1 to 160 bytes
Data Format	ASCII or Binary
Network Type	CSMA/CD
Processor	PIC16F628
Clock	4 MHz
Communications	9600 Baud, N, 8, 1
Peripheral Baud Rate	150, 300, 600, 1200, 1800, 2400, 4800 or 9600
Peripheral Parity	Even, Odd or None
Peripheral Data bits	4, 5, 6, 7 or 8
Peripheral Stop bits	1 or 2
Power Requirements	+8 to +30 VDC
Current Draw	15 to 27 mA, plus any current out of DTR pin
Operating Temperature	-20°C to +80°C
Board Dimensions	3.1" x 2.0" x 0.7"
Weight	1.8 oz

TABLE 1: ADDRESS SETTING

HEADER CHARACTER ASCII (HEX)	DIP SWITCH SETTING 1=on, 0=off 1 2 3 4 5
A (41)	0 0 0 0 0
B (42)	0 0 0 0 1
C (43)	0 0 0 1 0
D (44)	0 0 0 1 1
E (45)	0 0 1 0 0
F (46)	0 0 1 0 1
G (47)	0 0 1 1 0
H (48)	0 0 1 1 1
I (49)	0 1 0 0 0
J (4A)	0 1 0 0 1
K (4B)	0 1 0 1 0
L (4C)	0 1 0 1 1
M (4D)	0 1 1 0 0
N (4E)	0 1 1 0 1
O (4F)	0 1 1 1 0
P (50)	0 1 1 1 1
a (61)	1 0 0 0 0
b (62)	1 0 0 0 1
c (63)	1 0 0 1 0
d (64)	1 0 0 1 1
e (65)	1 0 1 0 0
f (66)	1 0 1 0 1
g (67)	1 0 1 1 0
h (68)	1 0 1 1 1
i (69)	1 1 0 0 0
j (6A)	1 1 0 0 1
k (6B)	1 1 0 1 0
l (6C)	1 1 0 1 1
m (6D)	1 1 1 0 0
n (6E)	1 1 1 0 1
o (6F)	1 1 1 1 0
p (70)	1 1 1 1 1

STACKABLE DATA MODULES

All modules in this series incorporate two EIA/TIA-232E serial ports which communicate at 9600 baud, no parity, 8 data bits and 1 stop bit. DB9 connectors are jumpered to satisfy hardware handshaking. The port labeled ''HOST'' is configured as a DCE device and should be connected to a PC's serial port. The port labeled ''SLAVE'' is a DTE device and can be left open, or connected to another module's host port. Up to 32 modules can be chained together in this fashion to form a network. Either plugged together end to end, or separated by a cable. Because a module contains two individual bi-directional ports which pass data through, it also acts as a repeater, extending the total allowable length of the RS-232 communications line.

A modem can serve as the host for remote operation, but since a modem uses a DCE port, a ''null modem'' adapter must be placed between the modem and the data module's host port. A gender changer may also be required. In addition, any hardware/software flow control must be disabled in the terminal program.

Each module in a network should be set to a different address using the on-board 32-position DIP switch. A module will only respond to data packets that begin with its' own unique header character, which is determined by this DIP switch setting. See Table 1. Data packets transmitted by a module will also begin with this header character. The host PC can use the header character to address each individual module in a network, and to identify a module which is talking.

COLLISION CONTENTION

The utilization of the communications line can be thought of more as a single, bi-directional, data bus, operated in a multi-drop mode rather then a standard RS-232 data link. A transmission from a data module travels in both directions, upstream to the host, and downstream to signal other modules that it has seized the line. Before transmitting, a module will listen to the communications line and wait for quiescence. After a silent period equal to the length of one byte, the waiting module will send its data packet using a Carrier Sense Multiple Access with Collision Detection communications protocol. See the application note (AN100) at the back of this manual for more details.

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TABLE 2: BAUD RATE JUMPERS

BAUD	JUMPERS
150	1
300	2
600	1, 2
1200	3
1800	1, 3
2400	2, 3
4800	none
9600	1, 2, 3

BAUD RATES

Although the Stackable Data Module network is fixed at 9600 baud, the WTMPI supports various baud rates which can be used when interfacing to third-party devices which require a different communications speed. All transmissions from the host will be converted from 9600 baud to the required rate prior to sending to the peripheral. All transmissions from the peripheral will be converted to 9600 baud.

Three jumpers on board the data module are used to select the desired peripheral communications rate as shown in Table 2. Keep in mind that this jumper configuration is only read at power up. If the jumpers are changed, the new baud rate will not go into effect until after power is cycled. To change the Parity, Data bits, or Stop bits, transmit a command string to the WTMPI containing the following: "{Header}wtmpi-m,{parity},{databits},{stopbits}". These settings will remain even after power is cycled. To read the current setting, transmit the command string "{Header}wtmpi-m".

COMMUNICATIONS RESTRICTIONS

As shown in Figure 1, there are a few communication restrictions which must be adhered to when transferring data to and from the peripheral, and is listed below.

1. A data frame must not contain more then 160 bytes or characters.

2. The data signal in a frame must be continuous with no more then 50 mark bits between each data byte.

3. Time between frames transmitted by the peripheral must be sufficient enough to allow data to be transferred to the host at 9600 baud including any delays waiting for bus availability.

4. Time between frames transmitted by the host must be sufficient enough to allow data to be transferred to the peripheral at the baud rate selected by the jumpers.

OPERATION

Use an RS-232 cable with DB9 connectors to hook the data module to a host PC. Connect a power source to the **+** and **-** terminals. Plug a peripheral device into the DB9 connector labeled "PERIPH". Set the correct baud rate for the peripheral using the jumpers on the data module (see Table 2) and change the terminal program to operate at 9600 baud rather then the peripheral's communications rate. Apply power to the data module and peripheral.

Send data to the peripheral in the same manner as usual except append the appropriate header character (see Table 1) to the beginning of each transmission. Any data received from the peripheral will also have this header character appended to it which will have to be striped off by the terminal program before processing in the normal fashion. The red LED on board the data module will flash each time data is transferred.

FIGURE 1: DATA FRAMES
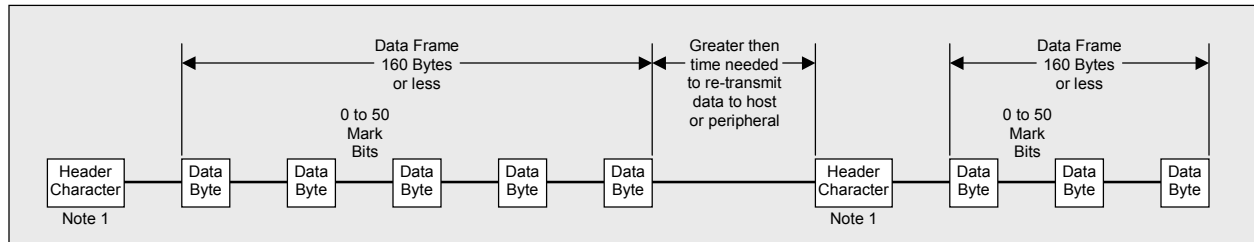
Note 1: Header character is not present on data received from peripheral; this will be the first data byte of the frame.

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TABLE 3: TERMINAL / CONNECTOR DESCRIPTION

NAME	TYPE	ELECTRICAL SPECS	COMMENTS:
HOST	DB9 (female)	EIA/TIA-232E Standard	RS-232 serial port configured as DCE. Connects to host PC. Hardware handshake jumpered.
SLAVE	DB9 (male)	EIA/TIA-232E Standard	RS-232 serial port configured as DTE. Can be connected to another data module's HOST port for networking.
Power Source	Jumper	N/A	Power source selection jumper. Selects either external, or port powered. (Note 1)
+	Screw Term	+8 to +30 VDC	External unregulated power supply input.
-	Screw Term	GND	External power supply ground.
PERIPH	DB9 (male)	TD = -9 VDC to +5 VDC RD = 5KΩ impedance DTR tied to V$_{IN}$+	RS-232 serial port configured as DTE. Connects to COM port of peripheral. DTR pin can be used to supply power to device.

Note 1: Selecting "port powered" will draw from the power supply source of an upstream data module. Caution, the USB or COM port of a PC or laptop does not supply enough current to serve as the power supply source.

DATA FLOW

Data is transferred to and from the peripheral in frames which can be up to 160 bytes long (see Figure 1). The data bytes that make up a frame can be of any form, binary, ASCII, extended ASCII, etc.

When a data frame is transmitted from the peripheral to the host, it is first captured and stored in RAM. This is done by reading all bytes until encountering a silent period greater than the length of 5 bytes. The header character is then added to the beginning of the frame, the baud rate set to 9600, and the contents of RAM is transferred on to the host using the standard anti-collision techniques practiced in the Stackable Data Module protocol.

When a data frame is transmitted from the host to the peripheral, the header character is examined first to see if it matches the DIP switch setting on the data module. If so, all data bytes are read and stored in RAM until encountering a silent period greater than the length of 5 bytes. The contents of RAM, excluding the header character, will then be transferred on to the peripheral at the baud rate selected by the jumpers.
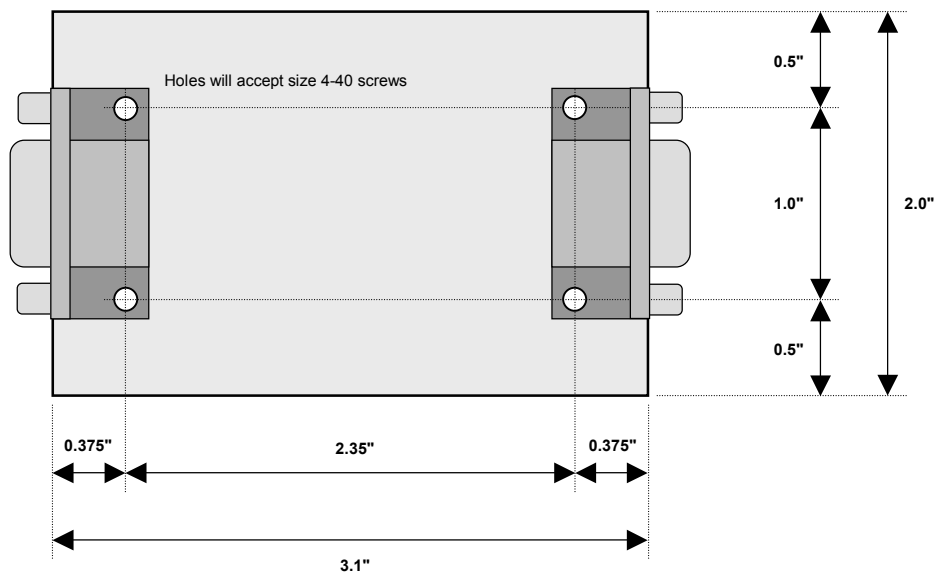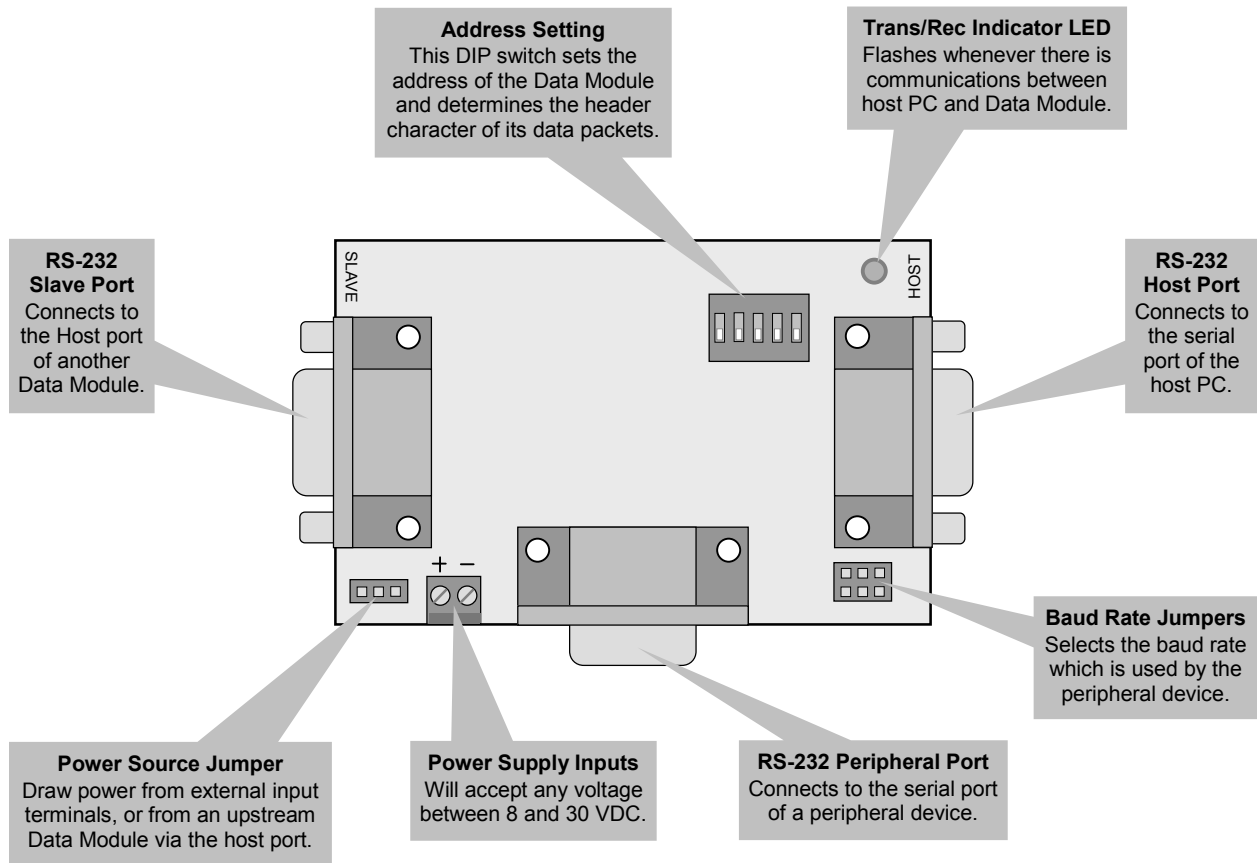
During any data frame reception from the peripheral or the host, the data which begins first will take priority. For instance, if the peripheral starts to transmit while the WTMPI is currently receiving a data frame from the host, the data frame from the peripheral will be missed.

CONTINUOUS DATA TRANSMISSION

Some peripherals report data readings to a PC on a continuous bases without being instructed to or polled by the host. This is more common with equipment taking live measurements such as weight, temperature, pressure, etc. In these cases, provided there is a 5-byte separation between data packets, the WTMPI can still process the data and transfer it on to the host even though the data structure may violate the data frame restrictions as shown in Figure 1.

This is done by continuing to monitor the peripheral data stream even while a current packet is being transmitted to the host. This allows the WTMPI to track the start and stop positions of the data and be ready to pick back up at the beginning of the next available frame, once it has been released from its current communications task. And since, in this case, the data is live and somewhat repetitive, extra readings that do not fit the time slot available on the multi-drop bus can simply be discarded without loosing critical data or information in the process.

Address Setting
This DIP switch sets the address of the Data Module and determines the header character of its data packets.

Trans/Rec Indicator LED
Flashes whenever there is communications between host PC and Data Module.

RS-232 Slave Port
Connects to the Host port of another Data Module.

RS-232 Host Port
Connects to the serial port of the host PC.

SLAVE

HOST

+ −

Baud Rate Jumpers
Selects the baud rate which is used by the peripheral device.

Power Source Jumper
Draw power from external input terminals, or from an upstream Data Module via the host port.

Power Supply Inputs
Will accept any voltage between 8 and 30 VDC.

RS-232 Peripheral Port
Connects to the serial port of a peripheral device.

Holes will accept size 4-40 screws

0.5"

1.0"

2.0"

0.5"

0.375"

2.35"

0.375"

3.1"

MULTI-DROP PERIPHERAL INTERFACE
WTMPI-M