



PRF
SDI-12 RADIO MODEM

User Reference Manual

Firmware Revision: MASTER V.274, SLAVE V. 236

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<http://www.amassdata.com>

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PRF
Radio Modem
Pliant Technology Specialists

Pliant: readily yielding to influence

1. **PRF: Pliant Radio Modem with Multiple Communications Interfaces**

The **PRF** Environmental Radio Modems are reliable and highly adaptable units which provide a wireless connection between devices with a wide variety of communications interfaces including RS232, RS485 and HCMOS (eg. SDI-12) devices.

The **PRF** gives your stand-alone devices wireless remote communications capability without having to purchase additional interface equipment. Depending on the version in use, HCMOS, RS232, MODBUS RTU and SDI-12 devices may be connected directly to the PRF. This added capability is provided with reliability in all foreseeable environmental conditions.

The **PRF** is equipped with the following hardware communications ports:

- SDI-12 communications port,
- RS485 serial port,
- Programming port: RS232, 9600 baud, 8 data bits, 1 stop bit, no parity
- RF port for radio frequency signals.

1.1. **Theory of Operation**

The **PRF** radio modem network consists of the following:

- A host device which initiates the communications. For example: a data logger with SDI-12 port, a RS232 communications device such as a computer or a MODBUS RTU device such as a PLC
- One PRF configured as MASTER and connected to the host device.
- At least one PRF configured as SLAVE with a valid address. Valid addresses are 'A' through 'Z' (except 'R' which is reserved for the MASTER).
- Sensors are connected to the SLAVE modem(s). These can be SDI-12 (standard **PRF**) or MODBUS RTU (**PRF/RTU**) depending on the version of PRF. Only one type of sensor is supported on any given version of the PRF. Support for specific RS232 sensors can also be developed at the user's request.

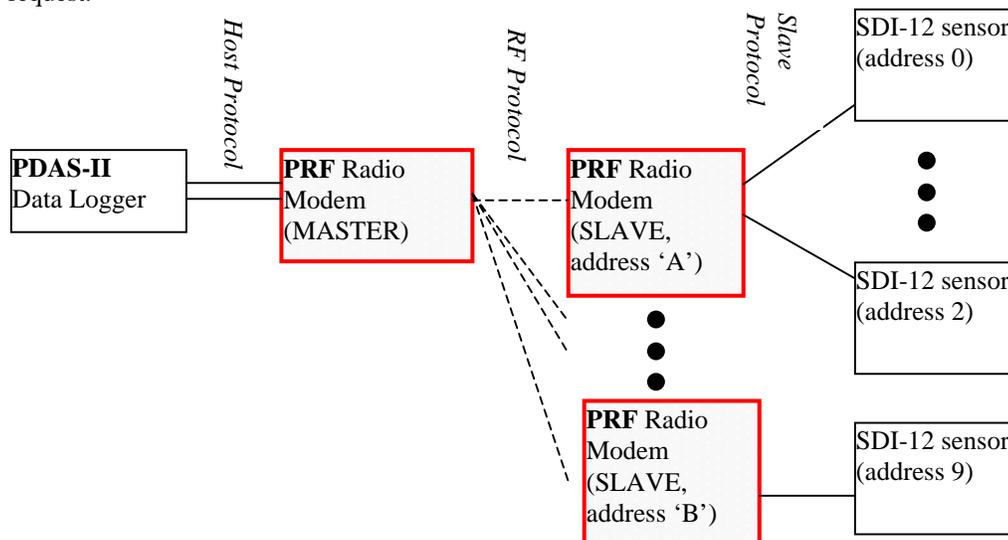


Figure 1. Wireless network solution using PRF radio modems.

1.2. Options

1.2.1. PRF

Until further notice is given, the standard PRF, as it is currently implemented, provides a wireless interface between a pseudo-SDI-12 host and standard SDI-12 sensor(s). **The host protocol is not standard SDI-12** but rather a pseudo version with relaxed timing. The host protocol for the PRF is implemented on SDI-12 port B of the PDAS-II data logger running software version *MDME065-Parks Canada*.

The PRF also provides wireless communication between a computer (with a serial port) and standard SDI-12 sensors via the RS232 port of the MASTER PRF. This configuration is depicted in Figure 3.

1.2.2. PRF/RTU

The PRF/RTU provides a wireless interface between an SDI-12 master and MODBUS RTU slaves.

2. Communications Protocol

2.1. Host Protocol

2.1.1. SDI-12

Until further notice is given, the only SDI-12 Host Device for the standard PRF is SDI-12 **port B** of the PDAS-II data logger running software version *MDME065-PARKS CANADA*. This uses the SDI-12 protocol but relaxes the tight timing constraints of the standard due to the time delays in the network. Also, the communications use a RS485, half-duplex communications interface to enable distances of up to 4000ft between the host device (PDAS logger) and the MASTER PRF.

HOST SDI-12 DEVICE: SDI-12 port B of the PDAS-II running software version *MDME065-PARKS CANADA* or similar.

Simply connect the PRF network to port B of the Host Device (refer to 4.2 for a description of the PRF connectors). The PRF radio modems operate transparently in the network and allow the host to access the remote sensors as though they were connected directly to the SDI-12 port.

2.1.2. RS232

The PRF is equipped with an RS232 port that is generally used for configuring the PRF via a computer serial port. The RS232 port is enabled using jumper “E1” as described in section 3.1 (install “E1”, then cycle the power to enable port).. To use the RS232 port the host device must be set to 9600 baud, 8 data bits, 1 stop bit and no parity.

2.2. Slave Protocol

The standard PRF supports standard SDI-12 sensors on the SLAVE(S) PRF units. Note that the SDI-12 protocol allows for a total of ten addressable sensors on a given network. Until further notice, the SDI-12 addresses of the sensors must be unique on the entire network depicted in Figure 1. Therefore, you CANNOT duplicate an SDI-12 address even though it is connected to another SLAVE PRF on the network. Therefore, you cannot have two SDI-12 sensors at address 0, for example, even though these two sensors are connected to separate SLAVE PRF units.

2.3. RF Protocol

The wireless communications that take place between the MASTER and SLAVE(S) PRF is transparent to the user. Therefore, the details of this protocol need not be known by the user in order to make use of the PRF radio modems. The baud rate of the RF communications take place at 57600.

Note that the PRF configuration as either MASTER or SLAVE is set at the factory and cannot be changed. The word “MASTER” or “SLAVE” should appear in the model name to designate its configuration.

2.3.1. PRF Addressing

The valid addresses for the SLAVE(S) PRF is (are):

‘A’ to ‘Q’ as well as ‘S’ to ‘Z’.

*****The MASTER PRF must be set to address “R”.

Refer to section 3.2 of this manual for changing the addresses of the SLAVE PRF radio modems. The default address of the SLAVE PRF is “A”. In order to have multiple SLAVES on the network each SLAVE must be at a unique address.

3. OPERATION

3.1. Using Jumper “E1”: Comm Port Selection

The jumper labeled “E1” is used to enable the desired communications port. As noted in section 1, the PRF is equipped with several ports, selection of which is accomplished with jumper “E1”. The selected Comm Port is where the PRF accepts and processes commands from the connected device. As such, jumper “E1” must be configured properly in order to communicate via the desired port.

For instance, under normal operation with the standard PRF (“E1” uninstalled), the host is usually connected to the SDI/RS485 port of the MASTER radio (Figure 1) and sends commands to that port. Alternatively, a computer may issue commands to the MASTER for the purpose of configuring it as well as communicating with the remote PRF, or even the SDI-12 sensors as depicted in Figure 3. However, accessing the MASTER PRF via a computer requires connection to its RS232 port. Jumper “E1” allows for this port selection. Refer to Figure 2 to locate jumper “E1”. The effect of Jumper “E1” depends on whether the PRF is configured as a MASTER or a SLAVE as per Table 1. Note that the same command set is available regardless of the host port in use.

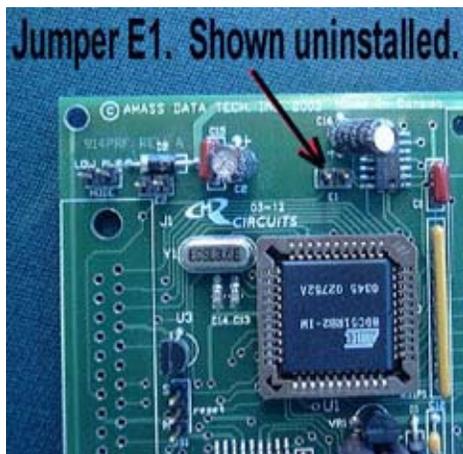


Figure 2. Location of Jumper "E1".

Table 1. Effect of Jumper "E1".

JUMPER “E1”	SLAVE PRF or MASTER PRF	EFFECT OF “E1” CONFIGURATION
INSTALLED	MASTER	<ul style="list-style-type: none"> ➤ Enable the RS232 port. ➤ Disable the SDI-12/RS485 port.
“	SLAVE	<ul style="list-style-type: none"> ➤ Enable the RS232 port. ➤ Disable the RF port.
UNINSTALLED	MASTER	<ul style="list-style-type: none"> ➤ Enable the SDI-12/RS485 port. ➤ Disable the RS232 port.
“	SLAVE	<ul style="list-style-type: none"> ➤ Enable the RF port. ➤ Disable the RS232 port.

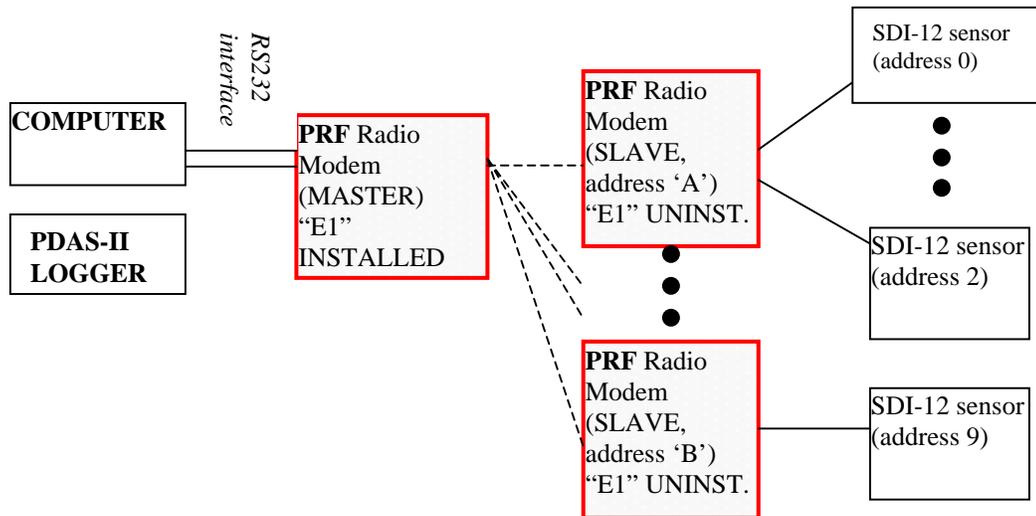


Figure 3. A computer connected to the MASTER PRF with "E1" installed.

Figure 4 below depicts a computer connected to one of the slaves ("E1" installed). The reason for doing this is either for reconfiguring the SLAVE (eg. Changing its address) or the sensors connected to it via the RS232 port.

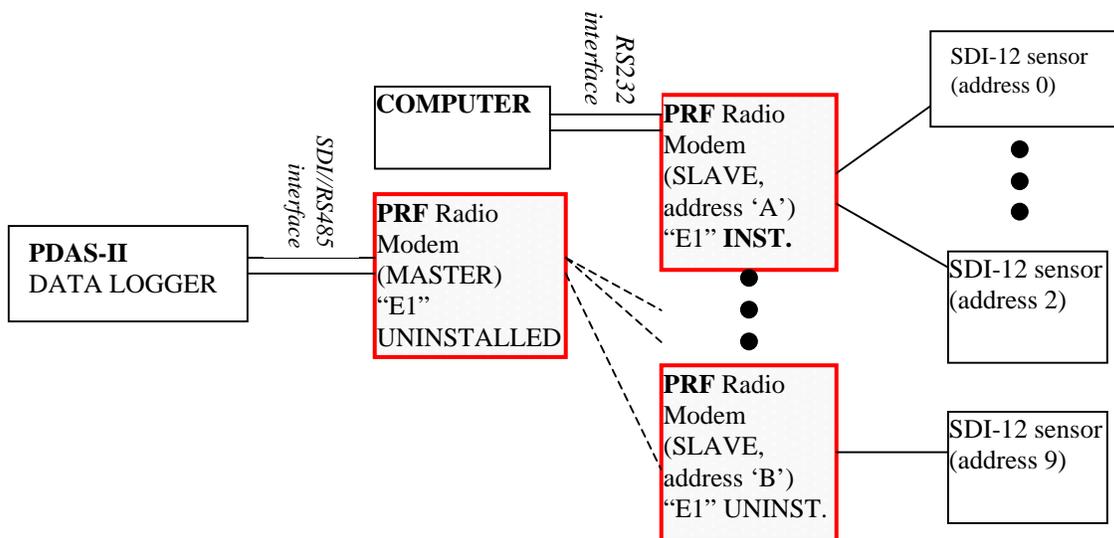


Figure 4. Computer connected to a SLAVE with "E1" installed.

3.2. PRF COMMANDS

The commands described in this section are for reading or changing the configuration of the PRF radio modems. In order to distinguish these commands from those that are destined for the sensors, they must be preceded with a valid PRF address as defined in 2.3.1. These commands may be issued via the SDI-12/RS485 port or the RS232 port (see section 3.1). Note, however, that if the host is the PDAS-II data logger the commands must be preceded with the SDI-12 port. Examples are included.

3.2.1. IDENTIFICATION COMMAND

This command instructs the PRF to send an identification string to the host. Included in this string is the firmware version number of the unit.

COMMAND: <address>I!

RESPONSE: <address><response string><CR><LF>

Where <CR>: carriage return character (0x0d)

<LF>: linefeed character (0x0A)

RS232 EXAMPLES: 1. To obtain the identification of the MASTER PRF (depicted in Figure 3) :

COMMAND: RI!

RESPONSE: R12AMASS PRF/SDI/HST274<CR><LF>

This response identified a PRF configured as MASTER (or “HST”) with firmware version 274.

2. To obtain the identification of the SLAVE PRF at address A:

COMMAND: AI!

RESPONSE: A12AMASS PRF/SDI/SLV 236<CR><LF>

This response identified a PRF configured as SLAVE with firmware version 236.

PDAS-II HOST EXAMPLE (SDI-12/RS485): To obtain the identification of the MASTER PRF:

COMMAND: BRI!

RESPONSE: R12AMASS PRF/SDI/HST274<CR><LF>

Note that the SDI-12 command is preceded with the PDAS-II port to which the MASTER PRF is connected. The MASTER PRF **must** be connected to SDI-12 port “B” of the PDAS-II (see section 2.1.1).

3.2.2. CHANGE ADDRESS COMMAND

The “A” command is used to change the address of the PRF radio modem. Each PRF address must be unique on the network. For example, a valid address arrangement would be as follows:

- MASTER at address “R”, SLAVES at addresses “A”, “B” and “C”.

Duplicating addresses on the network is incorrect. THE ADDRESS OF THE “MASTER” IS ‘R’ BY DEFAULT.

COMMAND: <current address>A<new address>!
RESPONSE: No response. The host should time-out.

RS232 HOST EXAMPLE: To change the address of the SLAVE PRF from ‘A’ to ‘B’:

COMMAND: AAB!
RESPONSE: No response

PDAS-II HOST EXAMPLE (SDI-12/RS485): To change the address of the SLAVE PRF from ‘C’ to ‘E’:

COMMAND: BCAA!
RESPONSE: No response

Note that the SDI-12 command is preceded with the PDAS-II port to which the MASTER PRF is connected. The MASTER PRF **must** be connected to SDI-12 port “B” of the PDAS-II

3.3. SENSOR COMMANDS

A network of standard PRF radio modems, as depicted in Figure 1, allows wireless communication between the host device and the remote SDI-12 sensors connected to the SLAVE(S) PRF. This is accomplished with the PRF units operating transparently. Therefore, to communicate with the SDI-12 sensors the host must simply transmit messages that are part of the sensors’ command set.

Although a few commands are common to all SDI-12 sensors, the full command set depends on the sensor in question. Refer to the documentation of the sensor.

RS232 HOST EXAMPLE : See Figure 3. To obtain the identification of the SDI-12 sensor at address 0:

COMMAND: 0I!
RESPONSE: 013 AMASS DATA PSE D200<CR><LF>

PDAS-II HOST EXAMPLE (SDI-12/RS485): See Figure 1. An AMASS DATA PSE-SDI shaft encoder is at address 0. Obtain a reading of the water level:

COMMAND: B0M0!
RESPONSE: 00001<CR><LF>0+12.229<CR><LF>

Note that the SDI-12 command is preceded with the PDAS-II port to which the MASTER PRF is connected. The MASTER PRF **must** be connected to SDI-12 port “B” of the PDAS-II

4. INSTALLATION

4.1. Electrical

The PRF power source must deliver between +8VDC and +30VDC. Connect the power source to the screw terminals as per Table 2.

4.2. Connectors

The PRF is equipped with the following connectors:

- DB9S : RS232 port
- MMCX jack: RF port for connection to your antenna
- 10-position terminal block: SDI-12, RS485, power connections

Table 2. Screw terminal connector designations.

TERMINAL	SIGNAL
#1 (See photo)	GROUND
2	+12VDC
3	Switched +12VDC
4	Event counter
5	GROUND
6	EARTH
7	485Tx*
8	485Tx
9	SDI/485Rx
10	SDI/485Rx*



Figure 5. Location of screw terminal #1 on the PRF.

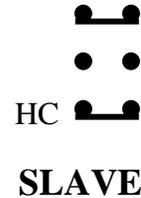
Table 3. DB9S RS232 port. Use a standard null modem cable.

Pin	Signal
2	PRF Tx
3	PRF Rx
5	GROUND

4.3. Jumpers

Jumper “E1” enables or disables the RS232 port on the SLAVE and MASTER PRF radio modems as described in section 3.1.

The other jumper block of note is simply labeled “HC”. This jumper block configures the second serial port as either SDI-12 (HCMOS), RS485 FULL-DUPLEX or RS485 HALF-DUPLEX. As mentioned in section 2.1.1, the MASTER PRF must be configured to support SDI-12/RS485 (see below). The SLAVE PRF should be configured to support standard SDI-12 (See below).



5. SPECIFICATIONS

Processor : Atmel 89C51RB2 @ 3.6864 MHz.
Word Size : 8 bit data - 8 bit instruction
EEPROM 2 kbytes

Power Consumption
200mW while transmitting.

RADIO MODULE
AEOROCOMM AC3124, 200Mw

Environmental Characteristics
Operating : -40 to +55 C
Storage : -60 to +100C
Humidity : <= 100% non-condensing

RANGE
2000 metres

- Connectors
- 10-screw terminal header:SDI-12, RS485, power, event counter, switched +12VDC port
 - DB9S programming port:RS232
 - MMCX JACK: for the RF antenna

PRF Output
Software-controlled switched +12VDC port

PHYSICAL CHARACTERISTICS
Height – 150 cm. (6 in.)
Width – 150 cm. (6 in.)
Depth – 150 cm. (6 in.)

Power Supply
Power supplied by a 8 to 30 VDC source.

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AMASS Data Technologies Inc.
812 Proctor Ave., Box 707
Ogdensburg, New York
13669
TEL: 315 393-3793 FAX 315 393-9017

AMASS Data Technologies Inc.
702 Route 105, Chelsea QUEBEC J9B 1L2
TEL: 819 827-0077 FAX: 819 827 4305
Email: sales@amassdata.com