WARWICK WIRELESS
LIMITED

XNET RADIO TELEMETRY NETWORK

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1.0 FEATURES

The XNET Radio Telemetry Network offers a cost effective and flexible means of transmitting analogue, digital and pulse counter data over large areas without the need for cables. A modular approach allows the user to configure different combinations of analogue and digital IO from standard XNET Modules. A system can be as simple as a one way link or as complex as a multi-drop network.

Each control module has an FM Radio Transceiver operating on the UHF UK & European licence & licence exempt 400MHz to 500MHz band. The radios conform to MPT1329, ETSI 300-220, ETSI 300-113 and ETSI 300-683.

The range of XNET modules include:

Control Modules

X8100	Transceiver Module
TX8100	Transmitter Module
TX8100LP	Low Power Transmitter Module
RX8100	Receiver Module

Expansion Modules

X8101	Digital Input Module
X8102	Digital Output Module
X8103	Pulse Output Module
X8104	Analogue Input Module
X8105	Analogue Output Module

Up to 15 Expansion Modules of each type can be connected to a Control Module by the serial XBUS.

A Serial Gateway is provided so that the IO on the radio network can be monitored and controlled from an external device such as a PC SCADA package or PLC.

A GSM Mobile Phone, Dial Up Telephone or Leased Line Interface can be connected to any Control Module thereby extending its range indefinitely.

2.0 SPECIFICATION

2.1 General

Each X8100 XNET Transceiver Control Module consists of:

8	Opto-isolated digital/pulse counter inputs
8	Relay outputs
2	Analogue inputs 0-20mA, 0-5V, 14 bit resolution
2	Analogue outputs 0-20mA, 0-5V, 14 bit resolution
1	RS232 serial gateway
1	RS232 programming port
1	X-Bus connector for expanded I/O
1	Antenna connector

Each TX8100 & TX8100LP XNET Transmitter Control Module consists of:

8	Opto-isolated digital/pulse counter inputs
2	Analogue inputs 0-20mA, 0-5V, 14 bit resolution
1	RS232 serial gateway
1	RS232 programming port
1	X-Bus connector for expanded I/O
1	Antenna connector

Each RX8100 XNET Receiver Control Module consists of:

8	Relay outputs
2	Analogue outputs 0-20mA, 0-5V, 14 bit resolution
1	RS232 serial gateway
1	RS232 programming port
1	X-Bus connector for expanded I/O
1	Antenna connector

2.2 Power Supply

DC Supply Voltage	12V to 30V d.c.
AC Supply Voltage	12V to 18V a.c.
DC Supply Current:	
Transmitting (Surge)	800 mA
Transmitting (Steady)	390 mA
Receiving	120 mA
Stand By	7 mA

2.3 Radio (standard)

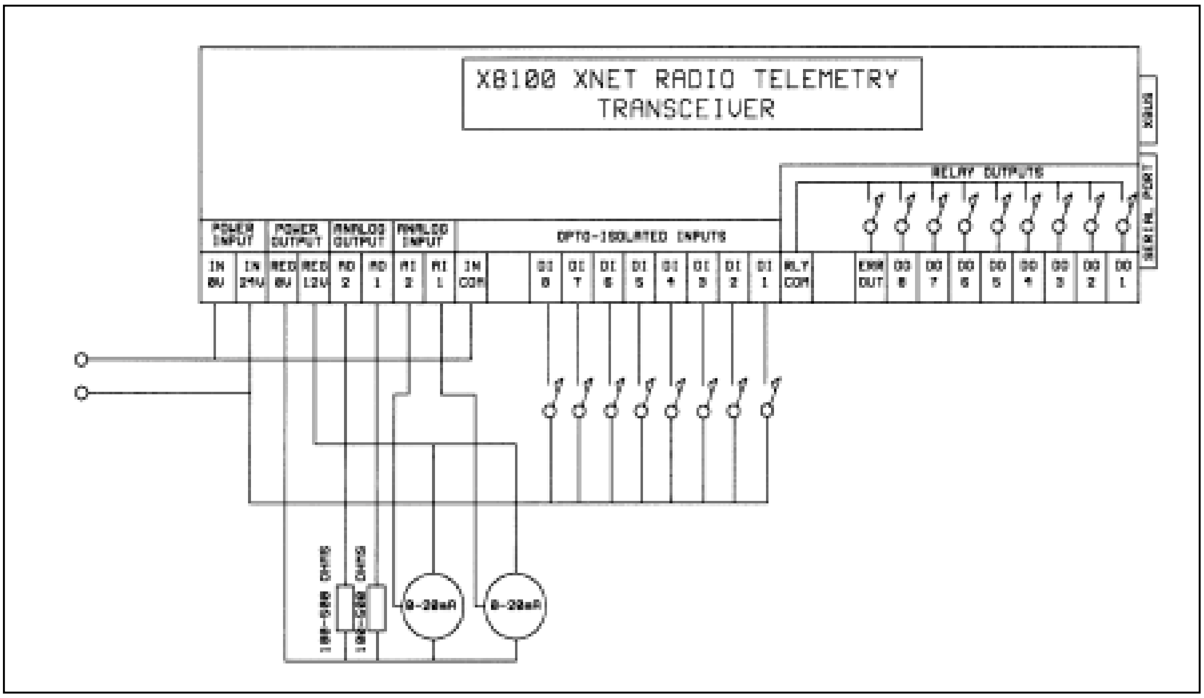
Frequency Range (UK)	458.525 MHz - 458.925MHz
Frequency Range (World)	400 MHz - 500MHz
RF Power	500m Watt
Channels	17
Channel Separation	25 KHz, 12.5KHz
Modulation	F3D, F1D
Receiver Sensitivity	Better than - 112 dBm

2.4 Mechanical and Environmental

Control Module Size	160 x 90 x 58 mm
Expansion Modules	53 x 90 x 58 mm
Mounting	DIN Rail
Operating Temperature Range	-20 to 55 deg C

3.0 HARDWARE CONFIGURATION

Figure 1 shows the terminal configuration for an XNET Control module.



3.1 Opto-Isolated Input (X8100, TX8100 & TX8100LP)

An XNET Control Module has 8 independent opto-isolated inputs with an input impedance of 4.7 K Ohms all have a common input IN COM. A d.c. supply of between 5 volts to 35 volts is needed to activate each input.

The Opto-Isolated Inputs can be programmed, in the configuration menu, to activate any output relay on the network. In addition a Test Mode can be selected which configures each input to its equal and opposite relay output.

Input	Program Def	Terminal	Description
IN	1.1	DI1	+Ve
IN	1.2	DI2	+Ve
IN	1.3	DI3	+Ve
IN	1.4	DI4	+Ve
IN	1.5	DI5	+Ve
IN	1.6	DI6	+Ve
IN	1.7	DI7	+Ve
IN	1.8	DI8	+Ve
IN COM			-Ve

Input 1.8 is used to indicate Battery Low Voltage for TX8100LP Control Module.

3.2 Digital Outputs (X8100 RX8100)

An XNET Control Module has 8 voltage free contacts rated at 24V d.c., 1 Amp or 220V a.c., 0.5 Amp. Each set of contacts can be programmed at the transmitter to respond to any opto-isolated input within an XNET network as long as it is in radio range. The one contact of the Voltage free contacts are connected to RLY COM.

Input	Program Def	Terminal	Description
OUT	1.1	DO1	Relay contact
OUT	1.2	DO2	Relay contact
OUT	1.3	DO3	Relay contact
OUT	1.4	DO4	Relay contact
OUT	1.5	DO5	Relay contact
OUT	1.6	DO6	Relay contact
OUT	1.7	DO7	Relay contact
OUT	1.8	DO8	Relay contact

3.3 Status Relay

The Status Relay will de-energise if there is a continuous break in the received data, if the received data is continually corrupted or if there is a power failure.

Terminal	Description
ERR OUT	Status relay contact

3.4 Analogue Inputs (X8100, TX8100 & TX8100LP)

Two 0-20mA or 0-5v analogue inputs are available on an XNET Control Module. Connections are made as follows:

Input	Program Def	Terminal	Description
AN1	1.1	AI1	Signal 0-20mA
AN2	1.2	AI2	Signal 0-20mA

Each analogue input is terminated by 250 ohms connected to 0v if the 0-20mA option is selected.

3.5 Analogue Outputs (X8100 & RX8100)

Two 0-20mA or 0-5v analogue outputs are available on an XNET Control Module. The current output is generated by connecting an external terminating resistor of between 100ohms & 600ohms (typically 250ohms), between each analogue output and 0v.

Check that this resistance is present in the transducer or actuator before connected to the analogue output.

Input	Program Def	Terminal	Description
AN1	1.1	AO1	Signal 0-20mA
AN2	1.2	AO2	Signal 0-20mA

If the terminating resistance is known a Volt Meter can be used to test the output.

If the terminating resistance is 250 ohms then a 4-20mA signal output will be 1- 5Volts

3.6 RS232/485 Serial Gateway

There are three options for the serial protocol, which can be selected when ordering an XNET system. They are:

a) Memory Dump Mode
b) Addressed Mode
c) Modbus

3.6.1 Memory Dump Mode (SCADA Interface)

The Memory Dump Mode interface can be connected directly to a Prodigy SCADA package. It is used for reporting the status of each analogue and digital input on the network. Command data can be transmitted to distant analogue and digital outputs via the serial port.

It is set by selecting the (M)onitor Mode in the configuration menu. Data is passed to and from the serial gateway at a baud rate of 9600, 8 bits, no parity and 2 stop bits.

Other nodes in the network do not have to be configured in the Monitor to be compatible.

3.6.1.1 Received Data

When the Monitor Mode is selected all digital and analogue data received by the XNET module is presented at the Txd port on the 9 way D Connector. The digital and analogue outputs, if present, will not be disabled.

Each input at each transmitter is programmed to a receiver output on a receiver Node. The input is memory mapped at the receiver Node.

NODE 001 D1.1 TO
NODE 000 D1.1

The first input on Node 1 would appear at the first memory location on Node 0. In the basic unit there is a maximum of 64 digital outputs and 64 analogue outputs. This can be extended to 128 digital and analogue outputs if required.

The XNET receiver will decode the incoming data and will identify the digital and analogue signals which contain the same node address. The destination port address will then be decoded and loaded into the appropriate output memory location.

Each time the X8100 Radio receives a packet of data, 64 analogue then 64 digital hexadecimal values are dumped to the serial gateway Txd port on pin L25. Simultaneously these values are sent to the programming port as ASCII decimal numbers and can be displayed on a PC in terminal mode. Analogue values will be 0 to 65535 and digital value will be either 0 for energised or 1 for de-energised.

The analogue data is transmitted from the serial port as follows:

The first two bytes will be the status of analogue output port 1.1. The second two bytes will be the status of analogue port 1.2. The last two bytes will be the status of analogue output 8.8.

The analogue string data will start with 41H (ASCII Character A) followed by the 64 received analogue values of 2 byte hexadecimal number (0000H to FFFFH).

At the end of the analogue data string 44H (ASCII Character D) will be sent. This will be followed by the digital data string. A digital ON state will be indicated by 30H (ASCII 0). A digital OFF state will be indicated by 3FH (ASCII?). At the end of the digital data string 0DH (ASCII CR) will be sent.

The digital data is transmitted from the serial port as follows:
The first two bytes will be the status of digital output port 1.1. The second two bytes will be the status of digital output port 1.2. The last two bytes will be the status of digital output 8.8.

3.6.1.2 Transmit Data

Analogue and digital data can be transmitted by radio to other XNET modules by monitoring CTS Terminal and presenting a data string to the Rxd Terminal

Each digital input has a memory location associated with it in the same way as for the digital outputs. Each input port is programmed to appear on an output port by means of the programming procedure described in 4.2 below. The Monitor Mode is selected and the Module set into normal operation.

At the end of each radio transmission the input memory stack pointer is reset to point at the first digital input 1.1.

The X8100 Transceiver will set RTS (Pin L26) high indicating that input data can be sent. The first byte sent to the serial port must be ‘D’ (44H). This is then followed by two data bytes. These can either be 3FH or 30H and are placed in the memory location allocated to input port 1.1. The second two bytes will be placed in the memory location allocated to input port 1.2. etc.

Each time a byte of data is received the stack pointer will automatically increment loading next data byte into the next input port location.

It is not necessary to send all 64 pairs of digital input bytes. If there are say 24 digital outputs in the network then only 24 pairs or bytes need to be sent.

When all the required digital outputs have been updated a Hexadecimal 41H (ASCII A) is sent. The X8100 will then expect 2 bytes of analogue data to be sent. The first 2 bytes will update the analogue output assigned to port 1.1, the second 2 bytes 1.2 etc.

RTS is brought low when the X8100 is about to transmit the contents of the input memory to the network.

A digital ON state will be indicated by 30H or ASCII 0.

A digital OFF state will be indicated by 3FH or ASCII?

An analogue value will be a hexadecimal number 0000H to FFFFH.

RTS will remain high for a minimum of 3 seconds at each cycle.

The values in the input memory are not changed after the contents have been transmitted over air so it is not necessary to load the memory each time RTS is brought high.

3.6.1.3 Test

By connecting a Dump Terminal to Txd, Rxd and 0v terminals the distant output ports can then be exercised by pressing either 0 to switch ports ON or pressing ? to switch them off. Data from distant nodes is displayed as either a 0 or ?

3.6.2 Addressing Mode

The Addressing Mode protocol is used to update and interrogate individual distant XNET transceivers.

Data is passed too and from the serial gateway at a baud rate of 9600, 8 bits, no parity and 2 stop bits.

A sequence is started by sending a 16 byte string to Rxd (Terminal L23) of Node 000. The 8 pairs of bytes represent the node address and the required status of 8 digital outputs on a distant XNET Transceiver.

The first two bytes represent the node address of the first output port followed by its required status, ON (00H) or OFF (FFH).

When the distant XNET Transceiver recognises its node address it will up date its digital and analogue outputs. It will then read its digital and analogue inputs and transmit them along with its own node address.

This data is received by Node 000 and passed to the Txd (Terminal L25) as a 16 byte string. The 8 pairs represent the origination address of the distant node along with the status of the inputs.

The first two bytes represent the node address of the first input port followed by its current status, ON or OFF.

3.6.3 Modbus

A modbus serial interface can be installed on the serial port if required.

3.7 RS232 Programming Port

An XNET Control Module is configured by connecting a Dumb terminal to the 9 way D connector. A simple three wire connection of Rd, Td and 0v is needed to make the connection. The Dumb Terminal is then set to:

Baud Rate	9600
Stop Bits	2
Parity	None

3.7.1 9 Way D Type

1	NC	
9	NC	
2	TRANSMIT DATA	(TD)
8	NC	
3	RECEIVE DATA	(RD)
7	NC	
4	NC	
6	WAKE UP	(TX8100LP)
5	GROUND	(0v)

CONNECT:	RECEIVE	ON HOST TO PIN 2	TRANSMIT ON XNET
TRANSMIT	ON HOST TO PIN 3		RECEIVE ON XNET
0V	ON HOST TO 0 VOLTS ON XNET		

3.7.2 Test

The connections can be tested by connecting a dump terminal to the 9 way D Connector. If there is no response when the ESC key is pressed then proceed as follows:

1) With the dumb terminal connected, use a Volt Meter to measure the voltage between 0V -Ve and pin 2 +Ve. The volt meter should read between -5v to -15v.

2) Connect the Volt Meter between 0V -Ve and pin 3 +Ve. The volt meter should read between -5v to -15v.

If only one of the pins is at a negative voltage then the connections on pin 2 and pin 3 are reversed.

3.8 X - Bus Port

The 10 way IDC connector is used to communicate with expansion IO modules. Up to 128 digital or pulse counter inputs, 128 digital or pulse counter outputs, 128 analogue inputs (0-5v or 0-20mA) and 128 analogue outputs (0-5v or 0-20mA) can be accessed via this port.

3.9 Power Supply

An XNET Control Module power supply can be hardware configured for connection to the following voltages.

14v to 30v d.c. at 1.5A
12V to 18V a.c at 1.5A

Power is connected to terminals IN 0V and IN 24V

A regulated 12v d.c. at 100mA output is available on terminals REG 0V , REG 12V. this can be used as a wetting voltage for the opto-isolated inputs or to drive external transducers.

3.9.1 Powered Terminals

Terminal	Voltage	Description	
ac	IN OV	12V-18V a.c.	Input
IN 24V	12V-18Va.c.	Input	
dc	IN OV	12V-30V d.c..	Input
IN 24V	12V-30V d.c.	Input	

3.9.2 Regulated 12v Output

REG 0V	12v at 100mA	-Ve	Output
REG 24V	12v at 100mA	+Ve	Output

4.0 OPERATIONAL MODE

The XNET network operates by allocating each Node a time slot in which it can transmit its data. The network is co-ordinated by a network manager which at the beginning of each cycle transmits a Time Slot Zero message to all the Nodes. Each Node then resets its internal clock and when the value of the internal clock corresponds with its programmed node number it transmits the data present on its inputs along with the address of the Node and Port to which the data has to be sent. Hence all the Nodes transmit their data in sequence.

If there is a break of more than 6 clock periods the Network Manager will transmit the time slot zero message once more and the sequence is repeated.

XNET Nodes which have a large amount of IO will require up to 5 time slots for transmission so that the IO can be loaded and read via the serial XBUS. For example if a manager has to monitor 10 digital and 10 analogue inputs then 2 time slots should be allocated. The first node number in the network would start from 3.

5.0 XNET NETWORK CONFIGURATION

5.1 X8100/TX8100 Network Configuration

5.1.1 Introduction

An XNET Node can be programmed by connecting a Dumb Terminal to the RS232 Serial Programming Port. The Terminal must be set to 9600 Baud, 2 Stop Bits and no Parity. A PC or lap top computer can easily be configured in this way.

5.1.2 Configuration Mode

Press ESC Key

The Node will stop its current operation and enter the program mode.

The following message will be displayed:

(C) ONFIG (M) ONITOR
(T) EST (Q) UIT

Type C will allow a new configuration to be entered.

Type M Will return the Node to its normal operation but display all the data being received by the Control Module in real time. The Status Relay will be toggled by the internal clock.

Type T Will start the internal test program. All the digital and analogue inputs will be connected to there respective digital and analogue outputs. The Status Relay will be toggled by the internal clock. No data will be transmitted or received.

Type Q Will return the Control Module to full operation.

5.1.3 Configuration

After C has been pressed the following message is displayed:

NODE NUMBER

A 3 digit number has to be entered. the node number will define the time slot in which this Control Module will transmit its data so all the Nodes must be in a consecutive order.

If a Control Module is going to be defined as a Network Manager then the Node Number must be 000.

There must be one network manager in each network.

When the Node Number is entered, for example 001, the following message will be displayed:

NODE NUMBER 001 Y/N

Type N NODE NUMBER will be displayed again.

Type Y The following message will be displayed:

NODE 001 D1.1 TO
NODE 000 D1.1 Y/N/E

This means that the state of the digital input 1.1 of this Node (001 as programmed above) will be transmitted at time slot 1 to the digital output 1.1 on Node 000.

Type Y Will display the next digital input to be configured.

Type N The above configuration can be altered. The following message will be displayed:

NODE 001 D1.1 TO
NODE

Type The 3 digit number of the Node that is to be addressed by this input. For example Node 004

NODE 001 D1.1 TO
NODE 004 D

Type The number of the digital output port on node 004 that is to be activated by 001 D1.1. For example 2.4

NODE 001 D1.1 TO
NODE 004 D2.4 Y/N/E

Type N A different destination can be entered.

Type Y The next digital input is displayed

NODE 001 D1.2 TO
NODE 003 D1.4 Y/N/E

The above procedure is followed until all the required digital inputs are programmed. It is important not to configure any digital inputs that are not used as this will add to the transmission time and therefore to the overall required to cycle round all the inputs on the network.

Type E The Analogue Input configuration is entered at the first Analogue input.

NODE 001 A1.1 TO
NODE 000 A1.1 Y/N/E

The analogue inputs are configured to analogue outputs in the same way as above.

Type E At the last analogue input to be configured type E. This will return the Control Module to the operational mode.

Type E Then ESC to return to the main menu.

5.2 TX8100LP/RX8100LP Network Configuration

5.2.1 Introduction

The TX8100LP can be programmed for a power standby mode after which it will read and transmit the status of its inputs for a programmed number of times.

An XNET Node can be programmed by connecting a Dumb Terminal to the RS232 Serial Programming Port. The Terminal must be set to 9600 Baud, 2 Stop Bits and no Parity. A PC or lap top computer can easily be configured in this way.

5.2.2 Configuration Mode

Press ESC Key

The Node will stop its current operation and enter the program mode.

The following message will be displayed:

(C) ONFIG (M) ONITOR
(T) EST (Q) UIT

Type C Will allow a new configuration to be entered.

Type M Will return the Node to its normal operation but display all the data being received by the Control Module in real time. The Status Relay will be toggled by the internal clock.

Type T Will start the internal test program. All the digital and analogue inputs will be connected to there respective digital and analogue outputs. The Status Relay will be toggled by the internal clock. No data will be transmitted or received.

Type Q Will return the Control Module to full operation.

5.2.3 Configuration

After C has been pressed the following message is displayed:

ENTER OFF TIME PERIOD Y/N/E

A 3 digit number has to be entered which will represent the time that the Node will be in power standby mode. During this time the Standby LED will flash

If the standby override link is present on the D connector the Off Time Period will set the delay time on the status relay.

Hence if a TX8100LP Transmitter with an Off Time Period of say 2 is configured to a RX8100LP Receiver with an Off Time Period of 5 and the standby override link is present on the receiver. Then the Status Relay on the RX8100LP will de-energise if a transmission from the TX8100LP has not been received for 5 time periods.

ENTER TX COUNT PERIOD Y/N/E

A single digit number between 1 to 9 should be entered. This represents the number of times the data message will be transmitted.

NODE NUMBER

A 3 digit number has to be entered. The node number will define the time slot in which this Control Module will transmit its data so all the Nodes must be in a consecutive order.

If a Control Module is going to be defined as a Network Manager then the Node Number must be 000 entered.
There must be one network manager in each network.

When the Node Number is entered, for example 001, the following message will be displayed:

NODE NUMBER 001 Y/N

Type N NODE NUMBER will be displayed again.

Type Y The following message will be displayed:

NODE 001 D1.1 TO
NODE 000 D1.1 Y/N/E

This means that the state of the digital input 1.1 of this Node (001 as programmed above) will be transmitted at time slot 1 to the digital output 1.1 on Node 000.

Type Y Will display the next digital input to be configured.

Type N The above configuration can be altered. The following message will be displayed:

NODE 001 D1.1 TO
NODE

Type The 3 digit number of the Node that is to be addressed by this input. For example Node 004

5.3 Monitor Mode

When M is typed in the main menu the XNET Node will enter the Monitor Mode. All data received by this module will be displayed in real time.

The Node number of the transmitting Node will be indicated by the first digit and the status of the digital input (1 or 0) by the second digit.

If there were 2 control modules on the network, one configured as a manager and the other configured as Node 2 and the manager had 6 digital inputs configured (input ports 1.1 to 1.6) and input 1.3 and 1.5 were activated.

The following display would be given if Node 2 was connected to a dumb terminal and set to Monitor Mode.

1.1	1.2	1.3	1.4	1.5	1.6	Input Port Number
01	01	00	01	00	01	Transmission from Node 0

If the dumb terminal was then plugged into the manager and set to monitor mode and Node 2 had 4 inputs configured (input ports 1.1 to 1.4) and input 1.3 was activated then following would be displayed:

1.1	1.2	1.3	1.4	Input Port Number
21	21	20	21	Transmission from Node 2

5.4 Test Mode

BEFORE ENTERING THE TEST MODE DISCONNECT ALL CRITICAL FIELD OUTPUTS.

Entering the test mode removes the control module from the network and configures all the analogue and digital inputs to their respective outputs.

By activating a digital input the corresponding digital output will energise.

5.4.1 Calibrating Analogue Inputs

The calibration on the analogue inputs can be adjusted by inserting an analogue signal and monitoring the respective analogue output. The span of all the analogue inputs can be adjusted by turning the ADC span potentiometer. The zero is set automatically by the dual ramp ADC.

6.0 RADIO TRANSMISSION

The X8100 XNET Transceiver operates on the UHF 400MHz to 500MHz band. It can be factory set to select a RF frequency within 400KHz within this band.

The standard Transceiver operates on the 456.500MHz to 458.950MHz UK licence exempt telemetry band. There are 17 different channels within this band and it is possible to have up to 17 different XNET networks operating simultaneously over the same area. The channel frequencies can be set by DIL switches located inside the case of the RF module.

6.1 DIL Switch Settings

Channel No	RF Frequency	SW5	SW4	SW3	SW2	SW1
02H	458.525 MHz	ON	ON	ON	ON	OFF
04H	458.550 MHz	ON	ON	ON	OFF	ON
06H	458.575 MHz	ON	ON	ON	OFF	OFF
08H	458.600 MHz	ON	ON	OFF	ON	ON
0AH	458.625 MHz	ON	ON	OFF	ON	OFF
0CH	458.650 MHz	ON	ON	OFF	OFF	ON
0EH	458.675 MHz	ON	ON	OFF	OFF	OFF
10H	458.700 MHz	ON	OFF	ON	ON	ON
12H	458.725 MHz	ON	OFF	ON	ON	OFF
14H	458.750 MHz	ON	OFF	ON	OFF	ON
16H	458.775 MHz	ON	OFF	ON	OFF	OFF
18H	458.800 MHz	ON	OFF	OFF	ON	ON
1AH	458.825 MHz	ON	OFF	OFF	ON	OFF
1CH	458.850 MHz	ON	OFF	OFF	OFF	ON
1EH	458.875 MHz	ON	OFF	OFF	OFF	OFF
20H	458.900 MHz	OFF	ON	ON	ON	ON
22H	458.925 MHz	OFF	ON	ON	ON	OFF

6.2 RF Power Adjustments

The RF Power can be adjusted by means of a ten turn potentiometer located at the top left hand side. The control module is factory set to maximum output power.

Before adjusting this potentiometer a RF power meter should be connected to the antenna socket.

The Transmitter can be set to continuously transmit by shorting the two pins marked “KEY TX” located below the RF Adjust potentiometer.

Turn the potentiometer clockwise to reduce the RF Output Power.

6.3 Radio Propagation

When installing a XNET system there are a number of factors which should be considered as they will effect the performance of the radio link. These are:

Transmitter Power Output.
Height of Transmitter and Receiver Antenna.
Length of the feeder cables to the Antenna.
Type of Antenna used.
Surrounding Topography.
The Weather.

6.4 Antennas

The main types of antenna used in telemetry applications are as follows:

Helical
Half-Wave Dipole
Yagi

Helical Antenna

The helical stub antenna is robust, low cost and physically small. It has a gain of less than unity and therefore has a relatively short range.

Half-Wave Dipole

The half-wave dipole antenna has a unity gain. Its main application is to provide cost effective omni-directional radiation at base stations.

Yagi

This antenna is highly directional and has a high gain typically 3dB upward. It is the type of aerial commonly used in domestic televisions.

The output power of a transmitter connected to a Yagi antenna has to be reduced to conform to the DTI specification. This has the advantage of reducing interference from other sources and reducing the overall power consumed by the transmitter without affecting the range in the direction of orientation. The range of a receiver connected to a Yagi antenna is also extended in the direction of orientation.

6.5 Site Surveys

A site can be surveyed to establish the best position for XNET transceivers as follows:

1. Erect a XNET transceiver module at the base station.
2. Key the Transmitter by shorting the KEY TX terminals. The Tx LED will light.
3. Monitor the signal strength around the site by means of a scanning receiver set to the same frequency or the Rx LED on a second XNET Transceiver Module.

7.0 INPUT/OUTPUT MODULES

7.1 Introduction

There are five IO modules which can be connected to an XNET Node. These are:

X8101 Digital Input Module / Pulse Counter Input Module
X8102 Digital Output Module
X8103 Pulse Output Module
X8104 Analogue Input Module
X8105 Analogue Output Module

7.2 X-Bus Port

A 10 way IDC connector is used to communicate with other expansion IO modules and with the XNET Controller.

The bank address of the modules is set by DIL switches. Each type of module (digital input, digital output, analogue input or analogue output) added to the X-Bus must have a consecutive number set on these DIL switches. Hence up to 15 digital input modules, 15 digital output modules, 15 analogue input modules and 15 analogue output modules can be connected to the X-Bus

7.3 X8101 Digital Input Module

An XNET Input Module has 8 independent opto-isolated inputs with an input impedance of 4.7 K Ohms. A d.c. supply of between 5 volts to 35 volts is needed to activate each input. The external d.c. supply on pin L1 and L2 can be used for this function.

Any input can be programmed to activate any output within an XNET network as long as it is in radio range. The input number is set by the DIL switches as described below.

The X8101 Digital Input Module consist of:

8 Opto-Isolated Inputs (5v - 30v dc) (offered as digital inputs or pulse counters)
1 12V, 100mA wetting voltage output.
1 Power Supply 24Vdc or 18Vac

7.3.1 Pulse Counter

A X8101 can be configured as 8 pulse counters. Pulses up to 10 HZ will be counted and the accumulated number will be transmitted to a digital output module set in pulse output mode at every scan.

7.3.2 DIL Switch Settings

SW4	SW3	SW2	SW1	INPUT ADDRESS	BANK
ON	ON	ON	OFF	2.1 to 2.8	2
ON	ON	OFF	ON	3.1 to 3.8	3
ON	ON	OFF	OFF	4.1 to 4.8	4
ON	OFF	ON	ON	5.1 to 5.8	5
ON	OFF	ON	OFF	6.1 to 6.8	6
ON	OFF	OFF	ON	7.1 to 7.8	7
ON	OFF	OFF	OFF	8.1 to 8.8	8

7.3.3 Input Terminals

Input	Program Def	Terminal	Description
IN	1.1	DI1	+Ve
IN	1.2	DI2	+Ve
IN	1.3	DI3	+Ve
IN	1.4	DI4	+Ve
IN	1.5	DI5	+Ve
IN	1.6	DI6	+Ve
IN	1.7	DI7	+Ve
IN	1.8	DI8	+Ve
IN COM			-Ve

7.3.4 Power Supply

The X8101 XNET Module can be connected either to a 24V d.c. or 18V a.c. supply on terminals IN 0V and IN 24V

7.4 X8102 Digital Output Module

An X8102 Digital Output Module consist of:

8 Volt free outputs rated at 30v dc 240v ac, 10 Amps. (offered as Digital Outputs or Pulse Output Counters)

Each set of contacts can be programmed to respond to any opto-isolated input within an XNET network as long as it is in radio range. The output module number is set by the DIL switches as described below.

7.4.1 DIL Switch Settings

SW4	SW3	SW2	SW1	INPUT ADDRESS	BANK
ON	ON	ON	OFF	2.1 to 2.8	2
ON	ON	OFF	ON	3.1 to 3.8	3
ON	ON	OFF	OFF	4.1 to 4.8	4
ON	OFF	ON	ON	5.1 to 5.8	5
ON	OFF	ON	OFF	6.1 to 6.8	6
ON	OFF	OFF	ON	7.1 to 7.8	7
ON	OFF	OFF	OFF	8.1 to 8.8	8

7.4.2 Output Terminals

Input	Program Def	Terminal	Description
OUT	1.1	DO1	Relay contact
OUT	1.2	DO2	Relay contact
OUT	1.3	DO3	Relay contact
OUT	1.4	DO4	Relay contact
OUT	1.5	DO5	Relay contact
OUT	1.6	DO6	Relay contact
OUT	1.7	DO7	Relay contact
OUT	1.8	DO8	Relay contact

7.4.3 Pulse Counter

The X8102 can be used as 8 digital pulse counter output. Pulse counts received from a pulse counter input are counted down by switching the designated relay output on and off at 10 pulses per second.

7.4.4 Power Supply

The X8102 XNET Module can be connected either to a 24V d.c. or 18V a.c. supply on terminals IN 0V and IN 24V

7.5 X8104 Analogue Input Module

An X8104 Analogue Input Module Consists of:

Four 0-20m Amp or 0-5v Analogue inputs.

Any analogue input can be programmed to activate any analogue output within an XNET network as long as it is in radio range. The input module number is set by the DIL switches as described below.

7.5.1 DIL Switch Settings

SW4	SW3	SW2	SW1	INPUT ADDRESS	BANK
ON	ON	ON	OFF	2.5 to 2.8	2
ON	ON	OFF	ON	2.1 to 2.4	2
ON	ON	OFF	OFF	3.5 to 3.8	3
ON	OFF	ON	ON	3.1 to 3.4	3
ON	OFF	ON	OFF	4.5 to 4.8	4
ON	OFF	OFF	ON	4.1 to 4.4	4
ON	OFF	OFF	OFF	5.5 to 5.8	5

7.5.2 Input Terminals

Input	Program Def	Terminal	Description
AN1	2.1	+VE	Signal 0-20mA
	0V	0v	
AN2	2.2	+VE	Signal 0-20mA
	0V	0v	
AN3	2.1	+VE	Signal 0-20mA
	0V	0v	
AN4	2.2	+VE	Signal 0-20mA
	0V	0v	

Each analogue input is terminated by 250 ohms connected to 0v.

7.5.3. Power Supply

The X8104 XNET Module can be connected either to a 24V d.c. or 18V a.c. supply on terminals IN 0V and IN 24V

7.6 X8105 Analogue Output Module

An X8105 Analogue Output Module Consists of:

Four 0-20m Amp or 0-5v Analogue Outputs.

7.6.1 DIL Switch Settings

SW4	SW3	SW2	SW1	INPUT ADDRESS	BANK
ON	ON	ON	OFF	2.1 to 2.8	2
ON	ON	OFF	ON	3.1 to 3.8	3
ON	ON	OFF	OFF	4.1 to 4.8	4
ON	OFF	ON	ON	5.1 to 5.8	5
ON	OFF	ON	OFF	6.1 to 6.8	6
ON	OFF	OFF	ON	7.1 to 7.8	7
ON	OFF	OFF	OFF	8.1 to 8.8	8

7.6.2 Output Terminals

Output	Program Def	Terminal	Description
AN1	2.1	SIG	Signal 0-20mA
	0V	0v	
AN2	2.2	SIG	Signal 0-20mA
	0V	0v	
AN3	2.3	SIG	Signal 0-20mA
	0V	0v	
AN4	2.4	SIG	Signal 0-20mA
	0V	0v	

An external resistor of 100 ohms to 600 ohms or there equivalent must be connected between the output and 0v.

7.6.3. Power Supply

The X8101 XNET Module can be connected either to a 24V d.c. or 18V a.c. supply on terminals IN 0V and IN 24V

8.0 SAFETY

8.1 System Safety

Please note that any system based on radio is subject to interference from unpredictable sources therefore Fail Safe mechanisms should always be used in critical application. In addition XNET should not be used in life support or airborne civil defence application without written approval from an authorised representative of Warwick Wireless Ltd.

8.2 Electrical Safety

Live terminals could be exposed when a cabinet containing an XNET module is opened. Therefore only qualified personnel aware of the potential hazards should be permitted access. Care should be taken to isolate the power from a Module before handling or removing it from a cabinet. Power supplies should be clearly identified.

Warwick Wireless Ltd reserve the right to change the design or specification of an XNET Module without notification. In addition Warwick Wireless Ltd take no responsibility for the installation and operation of the product.

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