ETH-NODE1

Communications Support Document

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Contents

1.0 Introduction

The following document details the information that will be passed from the Ethernet Node which is a remote Ethernet connected sensor node to a PLC or any other remote device. The Ethernet Node is capable of being configured for sending data as a simple array over either Ethernet/IP or PROFINET and is also able to return information via Modbus TCP/IP.

Protocol Version
1

The protocol version indicates the current protocol supported by this document.

2.0 Ethernet/IP, PROFINET Protocol

When a request is made to the Ethernet Node, the Node responds by sending the complete data array listed below . The structure of the PLC data registers is the same as defined in the Modbus Protocol Section. *For a special limited data option for PROFINET see chart 3.1.0.*

3.0 Modbus Protocol

The following is a list of Modbus registers, these are read only (Input Registers – 3xxxx) registers. Items marked with (*) may depend on expansion card type.

Section	Field Name	Type	Data Register Address	Reference
Device Information	Device Type	UINT16	0	4.1.1
	Protocol Version	UINT16	1	4.1.2
	Serial Number High	UINT16	2	4.1.3
	Serial Number Low	UINT16	3	4.1.3
	PIC Firmware Version High	UINT16	4	4.1.4
	PIC Firmware Version Low	UINT16	5	4.1.4
	DIGI Firmware Version High	UINT16	6	4.1.5
	DIGI Firmware Version Low	UINT16	7	4.1.5
	Expansion Firmware Version High	UINT16	8	4.1.6
	Expansion Firmware Version Low	UINT16	9	4.1.6
	Rotary Switch	UINT16	10	4.1.7
	DIP Switch	UINT16	11	4.1.8
	Node ID	UINT16	12	4.1.9
	Reserved	UINT16	13-19	-

Sensor Data	Input 1 Value	INT16	20	4.2.2
	Input 2 Value	INT16	21	4.2.2
	Input 3 Value	INT16	22	4.2.2
	Input 4 Value	INT16	23	4.2.2
	Input 5 Value	INT16	24	4.2.2
	Input 6 Value	INT16	25	4.2.2
	Input 7 Value	INT16	26	4.2.2
	Input 8 Value	INT16	27	4.2.2
	Pulse Input 1 PPM	INT16	28	4.3.1
	Pulse Input 2 PPM	INT16	29	4.3.1
	4-20mA Input 1 Value	INT16	30	4.4.2
	4-20mA Input 2 Value	INT16	31	4.4.2
	Reserved	UINT16	32-49	-
Expansion Card Data	Expansion Type	UINT16	50	5.0.1
	Expansion Input 1	INT16	51	5.0.0
	Expansion Input 2	INT16	52	5.0.0
	Expansion Input 3	INT16	53	5.0.0
	Expansion Input 4	INT16	54	5.0.0
	Expansion Input 5	INT16	55	5.0.0
	Expansion Input 6	INT16	56	5.0.0
	Reserved	UINT16	57-64	-
Module Diagnostics	Error Code High	UINT16	65	4.6.1
	Error Code Low	UINT16	66	4.6.1
	Digi Heartbeat Counter	UINT16	67	4.6.2
	PIC Heartbeat Counter	UINT16	68	4.6.3
	Expansion Heartbeat Counter	UINT16	69	4.6.4
Hazardmon Status	HazardMon Connection Status	UINT16	70	4.8.1
	HazardMon UDF ID	UINT16	71	4.8.2
	HazardMon Port Number	UINT16	72	4.8.3
	HazardMon Heartbeat	UINT16	73	4.8.4
	Reserved	UINT16	74	-

Ethernet TCP/IP	DHCP	UINT16	75	4.7.1
	IP Address High	UINT16	76	4.7.2
	IP Address Low	UINT16	77	4.7.2
	Subnet Mask High	UINT16	78	4.7.3
	Subnet Mask Low	UINT16	79	4.7.3
	Gateway High	UINT16	80	4.7.4
	Gateway Low	UINT16	81	4.7.4
	DNS Server 1 High	UINT16	82	4.7.5
	DNS Server 1 Low	UINT16	83	4.7.5
	DNS Server 2 High	UINT16	84	4.7.6
	DNS Server 2 Low	UINT16	85	4.7.6
	MAC Address High	UINT16	86	4.7.7
	MAC Address Low	UINT16	87	4.7.7
	Reserved	UINT16	88-89	-

3.1.0 PROFINET Limited Selection

This special option can be selected via the webserver (see manual) and limits the information to 62 Bytes from the standard 252 Bytes.

Field Name	Type	Data Register Address	Reference
Device Type	UINT16	0	4.1.1
Protocol Version	UINT16	1	4.1.2
Serial Number High	UINT16	2	4.1.3
Serial Number Low	UINT16	3	4.1.3
Rotary Switch	UINT16	4	4.1.7
DIP Switch	UINT16	5	4.1.8
Node ID	UINT16	6	4.1.9
Input 1 Value	INT16	7	4.2.2
Input 2 Value	INT16	8	4.2.2
Input 3 Value	INT16	9	4.2.2
Input 4 Value	INT16	10	4.2.2
Input 5 Value	INT16	11	4.2.2
Input 6 Value	INT16	12	4.2.2
Input 7 Value	INT16	13	4.2.2
Input 8 Value	INT16	14	4.2.2
Pulse Input 1 PPM	INT16	15	4.3.1
Pulse Input 2 PPM	INT16	16	4.3.1
4-20mA Input 1 Value	INT16	17	4.4.2
4-20Ma Input 2 Value	INT16	18	4.4.2
Expansion Type	UINT16	19	5.0
Expansion Input 1	INT16	20	5.0
Expansion Input 2	INT16	21	5.0
Expansion Input 3	INT16	22	5.0
Expansion Input 4	INT16	23	5.0
Expansion Input 5	INT16	24	5.0
Expansion Input 6	INT16	25	5.0
Error Code High	UINT16	26	4.6.1
Error Code Low	UINT16	27	4.6.1
Digi Heartbeat Counter	UINT16	28	4.6.2
PIC Heartbeat Counter	UINT16	29	4.6.3
Expansion Heartbeat Counter	UINT16	30	4.6.4

4.0 Register Description

The following contains a written description of the usage of each register/data type. This is a common reference for both the command based array protocol (section 2.0) and the Modbus protocol (section 3.0). Note that some properties utilise two registers (such as Serial Number High/Low) and are usually denoted by High and Low to indicate which register holds the most significant bits.

4.1 System Information

4.1.1 Device Type

This specifies the type of network device that this is. For the ETH-NODE1 by default this should be **0x0002**.

4.1.2 Protocol Version

This is the protocol version as specified at the start of this document see section 1.0. The number given here should match what is specified in this document.

4.1.3 Serial Number

This contains a 32-bit serial number.

4.1.4 PIC Firmware Version

This holds the current firmware version of the PIC on board the Ethernet Node.

Bit	Description
0-7	Minor Software Version
8-15	Major Software Version
16-23	Hardware Version
24-31	Reserved

An example of this would be 0x00010203 which would be hardware version 1, major software version 2 and minor software version 3.

4.1.5 DIGI Firmware Version

This holds the current firmware version of the DIGI Module on board the Ethernet Node.

Version numbering is identical to 4.1.4.

4.1.6 Expansion Firmware Version

This holds the current firmware version of the Expansion Card on board the Ethernet Node.

Version numbering is identical to 4.1.4.

4.1.7 Rotary Switch

The rotary switch register displays the current state of the rotary switch on the Ethernet node (Value = 0-7). This is used for the Modbus RTU Node ID. More information is in 4.1.9.

4.1.8 DIP Switch

The Registers for the DIP switch store the current value of the switch on the Ethernet Node, these DIP switches are used to configure the nodes communication protocol as well as whether the analogue inputs are 4-20mA or Pulse inputs. The Ethernet Node can be forced into DHCP mode if needed during setup.

Bit	Description	Value = 0	Value = 1
0	Communication Protocol	PROFINET	Ethernet/IP
1	Temperature Unit	°C	°F
2	Analogue Input 1	4-20mA	Pulsed Input
3	Analogue Input 2	4-20mA	Pulsed Input
4	Bootloader Select	Enabled	Disabled
5	HazardMon	Enabled	Disabled
6	DHCP Override	DHCP	Device Settings
7	Modbus RTU Node ID	Rotary Switch	Internal
8-15	Reserved	N/A	N/A

4.1.9 Node ID

The Node ID holds the current slave ID for any Modbus RTU connections to the device (via expansion board). The method for configuring Node ID can be selected via the Modbus RTU Node ID DIP switch (see 4.1.8).

When set to use the rotary switch the value of the rotary switch is used for the Node ID. In the case of the rotary switch being set to 0, the Node ID is assigned to 100.

If the DIP switch is set to Internal then Node ID comes from a value stored on the device. This can be set using the IE-Node Configurator software. The Node ID can be set to any value between 1 and 247 this way.

4.2 NTC/Contact Input

Each NTC input can also be used as a contact switch. If the supply voltage is detected on the pin then it is considered to be closed, if a ground state is detected then it is considered to be open. Temperature will be detected as any value between this which would be supplied using an NTC sensor.

4.2.2 Value Register

The temperature is given through the Value register, this will return a value in 10x the unit specified through the DIP switch. So, a value of 24.6°F would be 246. Special values indicate the closed or open state for contact detection.

Value	Value (HEX)	Description
-30000	0x8AD0	NTC/Contact Open
30000	0x7530	NTC/Contact Closed
All Other Values	All Other Values	Temperature X 10

4.3 Pulse Input

There are 2 pulse channels available which share inputs with the 4-20mA inputs as A#1 and A#2. These must be selected via the DIP switch. When inactive the register will display -20000

4.3.1 PPM

This gives the current pulses per minute (PPM).

4.4 4-20mA Data

There are 2 4-20mA current loop channels available which share inputs A#1 and A#2 with pulse measurement channels. These must be selected via the DIP switch. When inactive the register will display -20000

4.4.2 Value Register

These sensors measure the current passing through each of the given inputs. The sensor can handle a maximum current of 20mA. The value given will be in µA in the range 0 – 20000. In the case of the current being greater than 20mA, the sensor will return the value 30000 which indicates a short circuit.

Value	Value (HEX)	Description
30000	0x7530	Short Circuit
All Other Values	All Other Values	Current (µA)

4.6 Diagnostics Information

4.6.1 Error Codes

This register provides information on the number and type of errors detected on the Ethernet Node.

Bit	Description
0	Parity Error Flag
1	Framing Error Flag
2	Buffer Overrun Flag
3	Timeout Error Flag
4	Checksum Error Flag
5-7	Reserved
8-15	Comms Error Count
16-20	Last Exception Code
21-31	Reserved

4.6.2 Digi Counter

This register stores the number of Ethernet/IP, PROFINET, or Modbus TCP/IP requests that the Digi module has received from remote devices.

4.6.3 PIC Counter

This register gives a count of the number of times the Digi module has sent messages to the PIC microcontroller.

4.6.4 Expansion Counter

This register tracks the number of times the PIC microcontroller has received messages from the current expansion board.

4.7 Network Information

These registers contain information pertaining to the Ethernet Nodes network settings.

4.7.1 DHCP

This register indicates whether DHCP is currently enabled for the Ethernet Node.

Value	Description
1	DHCP Enabled
0	DHCP Disabled (Static IP Mode)

4.7.2 IP Address

This register contains the current IP address, either derived through DHCP or specified for static IP.

4.7.3 Subnet Mask

This register contains the subnet mask.

4.7.4 Gateway

This register contains the Gateway IP address.

4.7.5 DNS Server 1

This register contains the IP address for the first DNS Server.

4.7.6 DNS Server 2

This register contains the IP address for the second DNS Server.

4.7.7 MAC Address

This register contains the least significant 4 bytes of the MAC address.

4.8 HazardMon Information

The following registers include information relating to the HazardMon monitoring tool.

4.8.1 HazardMon Connection Status

This register indicates whether HazardMon is currently connected:

Value	Description
0	HazardMon Disabled
1	HazardMon Disconnected (Check DNS / Domain Server)
2	HazardMon Connected
3	Unknown Device ID (Device requires setup on HazardMon)

4.8.2 HazardMon UDF ID

This register contains the UDF ID.

4.8.3 HazardMon Port Number

This indicates the port number that HazardMon will connect on.

4.8.4 HazardMon Heartbeat Counter

This indicates the number of successful transactions that have occurred between the Ethernet Node and HazardMon.

4.9 Internal NTC Sensor

The Ethernet Node includes a single NTC temperature sensor which is mounted to the PCB, this allows for monitoring of the internal temperature of the enclosure.

4.9.1 Internal NTC Temperature Value

The temperature is given through the Value register, this will return a value in 10x the unit specified through the DIP switch. So, a value of 24.6°F would be 246. Special values indicate the closed or open state for contact detection.

Value	Value (HEX)	Description
-30000	0x8AD0	NTC/Contact Open
30000	0x7530	NTC/Contact Closed
All Other Values	All Other Values	Temperature X 10

5.0 Expansion Cards

This section covers the types of information that each expansion card holds. In general all expansion cards consist of several more sensors and an RS485 port for communicating via Modbus RTU.

5.0.1 Types

This indicates what type of expansion card is connected. If an expansion card is plugged in and detected then this value should be a non-zero integer. The following table indicates what type of expansion card is connected:

Index	Expansion Type	Reference
0	No Expansion Connected	N/A
1	NTC Expansion Card (ETH-NODE-AUXI-6NTC)	5.1
2	4-20mA Expansion Card (ETH-NODE-AUXI-6AN)	5.2

5.0.2 Data

This set of registers contains sensor data relating to the connected expansion card. When no expansion card is connected the value of each register is 0xFFFF. Please see the relevant section listed in 5.0.1 for a detailed breakdown of the expansion cards sensor output.

5.1 NTC Expansion Card (ETH-NODE-AUXI-6NTC)

The NTC expansion card supports 6 further NTC/Contact sensor inputs and a RS485 Modbus RTU output. The following tables detail which registers are available. This applies to both Ethernet/IP, PROFINET, and Modbus TCP/IP.

5.1.1 NTC/Contact Sensor Value

These sensors work in an identical manner to that of the mixed NTC/Contact sensors available on the main board (4.2).

The temperature is given through the Value register, this will return a value in 10x the unit specified through the DIP switch. So, a value of 24.6°F would be 246. Special values indicate the closed or open state for contact detection.

Value	Value (HEX)	Description
-30000	0x8AD0	NTC/Contact Open
30000	0x7530	NTC/Contact Closed
All Other Values	All Other Values	Temperature X 10

5.2 4-20mA Expansion Card (ETH-NODE-AUXI-6AN)

The 4-20mA expansion card supports 6 further 4-20mA sensor inputs and a RS485 Modbus RTU output. The following tables detail which registers are available. This applies to both Ethernet/IP, PROFINET, and Modbus TCP/IP.

5.2.1 4-20mA Sensor Value

These sensors measure the current passing through each of the given inputs. The sensor can handle a maximum current of 20mA. The value given will be in µA in the range 0 – 20000. In the case of the current being greater than 20mA, the sensor will return the value 30000 which indicates a short circuit.

Value	Value (HEX)	Description
30000	0x7530	Short Circuit
All Other Values	All Other Values	Current (µA)