Operating Instructions

COMMUNICATIONS MODULE

(DNP3 Level 2 / Modbus Protocols)

ATevo Series

MICROPROCESSOR-CONTROLLED
FLOAT BATTERY CHARGER

p/n JA0102-54

User Notes

ATevo Battery Charger Safety

This manual provides operating instructions for the optional '**Communications Features**' of the ATevo Series microprocessor-controlled float battery charger. For a **full** set of safety instructions for accessing all internal components, refer to the main ATevo Battery Charger Operating & Service Instructions manuals:

- JA0102-51 - 1PH Input - Group I (6-25 Adc output)
- JA0102-52 - 1PH Input - Group II (16-100 Adc output)
- JA0102-53 - 3PH Input (16-1000 Adc output)

Communications Safety

1) Do not touch any uninsulated parts, especially the input and output connections, as there is the possibility of electrical shock.

2) Remove all jewelry (watches, rings, etc.) before proceeding with installation or servicing to avoid electrical shock hazards.

3) Use a ground strap while installing these sensitive components.

Equipment / Manual Signs

SIGN	MEANING
⚠ DANGER	imminently hazardous situation, which if not avoided, ***will*** result in death or serious injury
⚠ WARNING	potentially hazardous situation, which if not avoided, ***could*** result in death or serious injury
⚠ CAUTION	potentially hazardous situation, which if not avoided, ***could*** result in minor or moderate injury (e.g. minor burns, bruising from pinch points, minor chemical irritation) - may also be used to alert against unsafe practices
NOTICE	important information ***not*** related to personal injury (e.g. messages related to equipment or property damage)

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1.1 Overview

The ATevo Communications options allow users to remotely observe any status, or perform any function, that is accessible at the battery charger's front panel display.

Two (2) 'communications' option boards, supporting both DNP3 Level 2 and Modbus SCADA protocols, are available:

- Serial Communications Adapters (A12), supporting BAUD rates from 9600K to 115.2K for:
  - » 3-wire or 5-wire RS-232 connections
  - » 2-wire or 4-wire RS-485 connections
- Ethernet Communications Adapter (A22), supporting standard RJ-45 10/100 Mbps copper Ethernet connections

1.1.1 Forced Load Sharing

The ATevo **Forced Load Sharing** option similarly utilizes a Serial Communications Adapter (A13). For detailed information on Forced Load Sharing, refer to instructions (JA5054-50), or Section 13 of the main ATevo 'battery charger' Operating & Service Instructions manuals (JA0102-51, JA0102-52, or JA0102-53).

1.1.2 Limitations

The ATevo Communications provides users remote access to all battery charger **functionality**. Only battery charger controls (user input) and charger status (ATevo output) are accessible.

NOTICE At the time of printing of this manual, a remote graphical user interface (GUI) or a human-machine interface (HMI) is **not** supplied nor supported by the manufacturer of ATevo. These types of interfaces are sometimes provided by third parties.

1.1.3 ATevo Set Points & Firmware Defaults

Certain entries in the DNP (Section 5) & Modbus (Section 6) points tables are dependent on ATevo battery charger model. Ranges differ, depending on nominal output voltage (24, 48, 130, or 260 Vdc).

For a complete listing of these settings, download the latest revision of the ATevo Set Points & Firmware Defaults (JA5124-02).

2.1 DNP3 Overview

Communications options support DNP3 Level 2 protocol and change events with unsolicited messaging.

Serial Setting Supported		
Parity	**Data Bits**	**Stop Bits**
no	8	1
no	8	2
even	8	1
odd	8	1

Refer to Section 5 regarding DNP3 protocol and point list.

2.2 Modbus Overview

Communications options can be set to communicate on standard Modbus networks using either of two transmission modes:

Transmission Mode	Advantage of Mode	Serial Settings Supported		
ASCII	less strict serial timing requirements without causing errors	**Parity**	**Data Bits**	**Stop Bits**
		no	7	2
		even	7	1
		odd	7	1
RTU	higher throughput than ASCII due to more data transmission with less overhead	**Parity**	**Data Bits**	**Stop Bits**
		no	8	1
		no	8	2
		even	8	1
		odd	8	1

Refer to Section 6 regarding Modbus protocol and register set.

3.1 Serial Communications Adapter Option

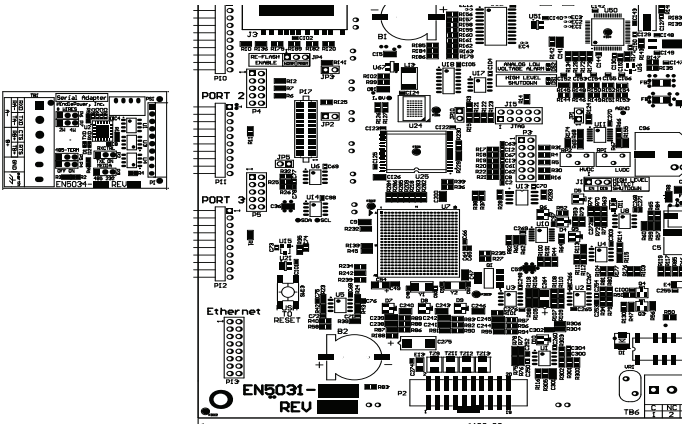
ATevo Communications can accept up to three (3) Serial Communications Adapters, supporting connections to either RS-232 or RS-485 networks. Serial Adapter hardware must be configured correctly before connecting to the network.

3.1.1 Serial Communications Adapter Installation

- For an enhanced version of these installation steps, refer to Service Instruction (JD5008-50).

Each Serial Adapter is configured independently and can be set to connect to different network types.

Serial Communications Adapters can be plugged into '**PORT 1**' (P10), '**PORT 2**' (P11), and/or '**PORT 3**' (P12) located along the left side of the Main Control Board. Both PORT 2 (P11) and PORT 3 (P12) will support DNP3 and Modbus protocols.



To install a Serial Communications Adapter:

- Turn off (open) both front panel AC Input (CB1) and DC Output (CB2) Circuit Breakers.
- Allow charger internal voltages to ramp down.
- ATevo display will go blank, and all LEDs will be off.
- Open the ATevo front panel door.
- Remove the ground connection from lower-left corner of the Main Control Board (A1).

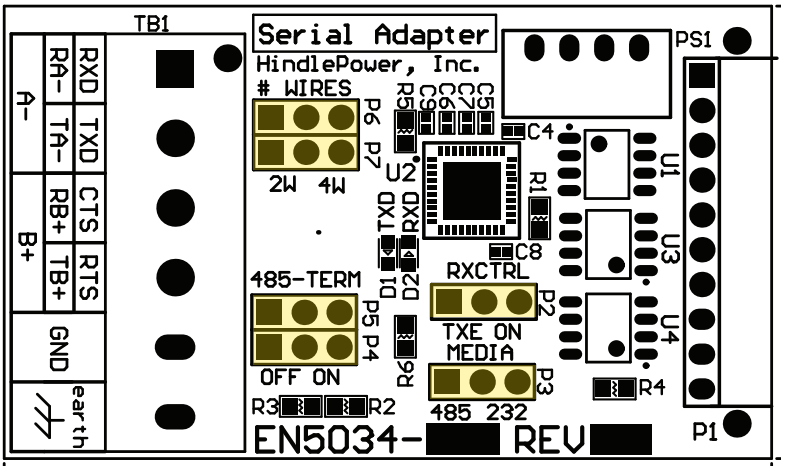
- Carefully disengage the Main Control Board (A1) from the left side standoffs.
- Make sure you correctly configured settings for Serial Communications Adapter Boards (see Sections 3.1.2 - 3.1.7).
- Locate the Serial Communications Adapter connection ports (P10, P11, & P12) along the left side of Main Control Board (A1).
- Carefully slide socket (P1) of the Serial Communications Adapter onto the pins of one (1) of the A1 connection ports (P10, P11, or P12). For Modbus or DNP3, use P11 or P12.
- Hold the Serial Communications Adapter at an angle, to clear standoffs on the back of the door.
- Once the Serial Communications Adapter socket is fully engaged on the Main Control Board header pins, line up the hole on the Serial Connection Board with the plastic standoff pin.
- Press down on **both** the Serial Communications Adapter and the Main Control Board, to lock them onto the standoffs.
- Replace the ground connection on the bottom-left side of the Main Control Board.
- Make note of which numbered port (2 or 3 for Modbus or DNP3), to which the Serial Communications Adapter is now connected.
- Close the ATevo front panel door.
- Turn on (close) the AC Input Circuit Breaker (CB1).
- Turn on (close) the DC Output Circuit Breaker (CB2).
- The Serial Communications Adapter hardware is now installed.
- Refer to Section 4 to assign a protocol and configure communications parameters (baud rate, parity, etc).

3.1.2 RS-232

RS-232 is a standard for serial data transmission. It is commonly used in pc serial ports for connections to modems, mice, and printers. It only permits two (2) devices to be connected together, has a limited cable distance, and is more susceptible to electrical noise than RS-485 networks.

3.1.3 3-Wire RS-232 Connections

To make connections and configure settings for 3-Wire connections between the Serial Adapter and an RS-232 network, use the following diagram and tables:

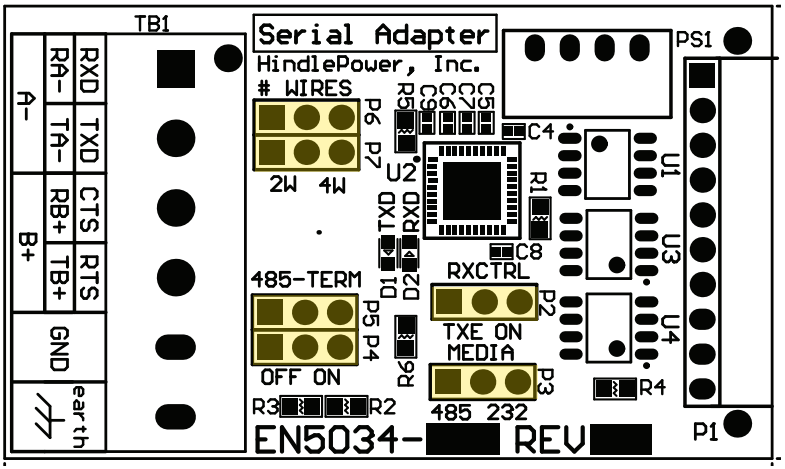


3-Wire RS-232 Settings		
Jumper(s)	**Label**	**Setting**
P3	MEDIA	232
P6, P7	#WIRES	4W
P2	RXCTRL	ON
P4, P5	485-TERM	OFF

Wiring Serial Adapter to RS-232 Network		
Adapter	**to**	**RS-232**
RXD (TB1-1)	to	TXD
TXD (TB1-2)	to	RXD
GND (TB1-5)	to	COM

3.1.4 5-Wire RS-232 Connections

To make connections and configure settings for 5-Wire connections between the Serial Adapter and an RS-232 network, use the following diagram and tables:



5-Wire RS-232 Settings		
Jumper(s)	**Label**	**Setting**
P3	MEDIA	232
P6, P7	#WIRES	4W
P2	RXCTRL	ON
P4, P5	485-TERM	OFF

Wiring Serial Adapter to RS-232 Network		
Adapter	**to**	**RS-232**
RXD (TB1-1)	to	TXD
TXD (TB1-2)	to	RXD
CTS (TB1-3)	to	RTS
RTS (TB1-4)	to	CTS
GND (TB1-5)	to	COM

3.1.5 RS-485

RS-485 is a standard, defining electrical characteristics of drivers and receivers for use in balanced digital multi-point systems. RS-485 networks can be used effectively over long distances in electrically noisy industrial environments. Multiple devices may be connected to the same network.

Some RS-485 networks may require termination resistors at both ends of the serial network. The decision of whether or not to use termination resistors should be based on the BAUD rate, the cable distance, and the type of cable being used to build the network. In most cases for BAUD rates less than 19.2K, termination resistors are not required. If termination resistors are used, the network must be designed with the appropriate biasing resistors to ensure reliable communications.

Biasing resistors ensure that the network remains in idle state when all drivers are tri-stated. To guarantee that the receivers remain in a known state, +/- 200mV must be maintained across the RS-485 inputs, (A) or (-) and (B) or (+). When termination resistors are used, this requires a significantly lower value of biasing resistors which results in greater dc loading of the network.

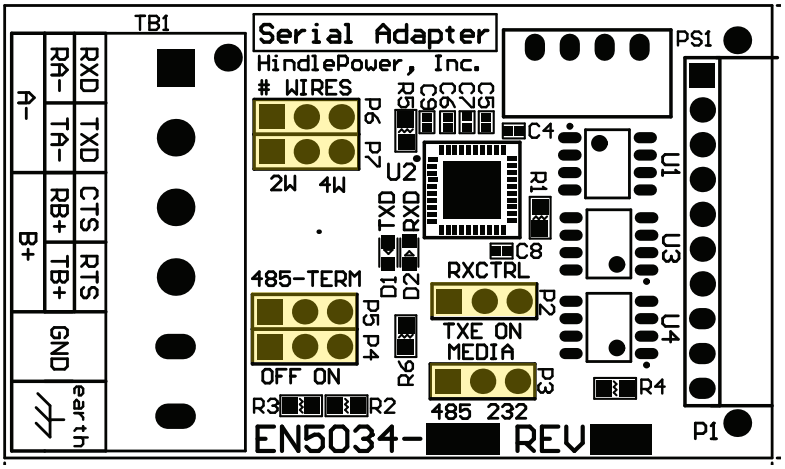
Network design and biasing resistor calculations depend on the number of network nodes, the type of drivers and receivers on the network, and any biasing already designed into other devices sharing the network. As a result, termination resistor decisions, and biasing resistor calculations are beyond the scope of this manual. For more information on biasing and termination details see the following references:

1. TIA-485 Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems
   https://global.ihs.com/
2. RS-422/RS-485 Application Note Copyright: B&B Electronics
   http://www.ATSeries.net/PDFs/RS422+485AppNote.pdf

The Serial Communications Adapter board (A12/A13) features configurable 120Ω termination resistors. Jumpers P4 and P5 enable or disable the terminating resistors.

3.1.6 2-Wire RS-485 Connections

To make connections and configure settings for 2-Wire connections between the Serial Adapter and an RS-485 network, use the following diagram and tables:



2-Wire RS-485 Settings		
Jumper(s)	**Label**	**Setting**
P3	MEDIA	485
P6, P7	#WIRES	2W
P2	RXCTRL	TXE
P4, P5	485-TERM	OFF

NOTICE *If you want to utilize the on-board termination resistor located on the Serial Adapter, set '**P5**' to the '**ON**' position. Termination resistors should only be placed on the extreme ends of the network (2 devices only). In addition, the network must be biased correctly or the termination resistors may cause communications errors.*

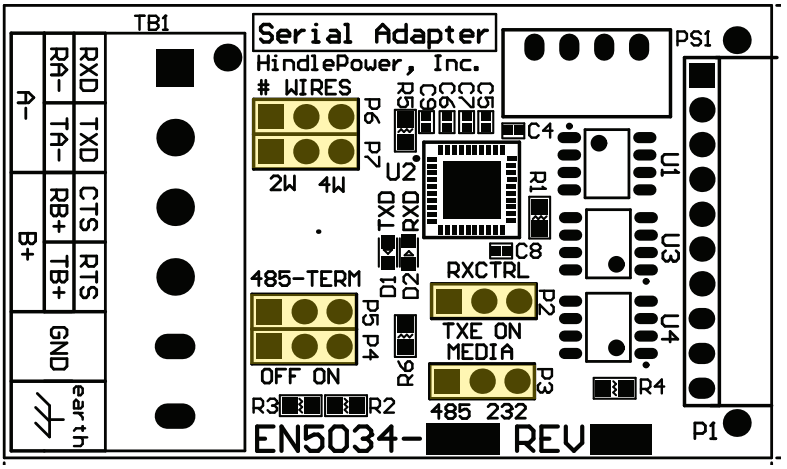
Wiring Serial Adapter to RS-485 Network		
Adapter	**to**	**RS-485**
A- (TB1-1)	to	A-
B+ (TB1-3)	to	B+
GND (TB1-5)	to	COM

NOTICE

- *When set to '**2W**', P6 connects TB1-1 to TB1-2.*
- *When set to '**2W**', P7 connects TB1-3 to TB1-4.*

3.1.7 4-Wire RS-485 Connections

To make connections and configure settings for 4-Wire connections between the Serial Adapter and an RS-485 network, use the following diagram and tables:



4-Wire RS-485 Settings		
Jumper(s)	**Label**	**Setting**
P3	MEDIA	485
P6, P7	#WIRES	4W
P2	RXCTRL	ON
P4, P5	485-TERM	OFF

NOTICE *To utilize the on-board termination resistors located on the Serial Communications Adapter, set '**P5**' & '**P6**' to the '**ON**' positions. Termination resistors should only be placed on the extreme ends of the network (2 devices only). In addition, the network must be biased correctly or the termination resistors may cause communications errors.*

Wiring Serial Adapter to RS-485 Network		
Adapter	**to**	**RS-485**
RA- (TB1-1)	to	TA-
TA- (TB1-2)	to	RA-
RB+ (TB1-3)	to	TB+
TB+ (TB1-4)	to	RB+
GND (TB1-5)	to	COM

3.1.8 Optional Serial Fiber Modems

Several optional serial converters are available for ATevo. When ordered, these options will be factory-installed, and allows direct connection of fiber optics compatible with standard 'B&B' and 'DYMEC' type converters. Refer to the following supplemental documents for the available Fiber Optics Interface options.

ATevo Fiber Optics Interface Options	
Interface p/n	**Supplemental Documentation**
EJ5230-5#	'B&B' Fiber Optics Interface
EJ5230-6#	'DYMEC' RS485 Fiber Optics Interface
EJ5230-7#	'DYMEC' RS232 Fiber Optics Interface

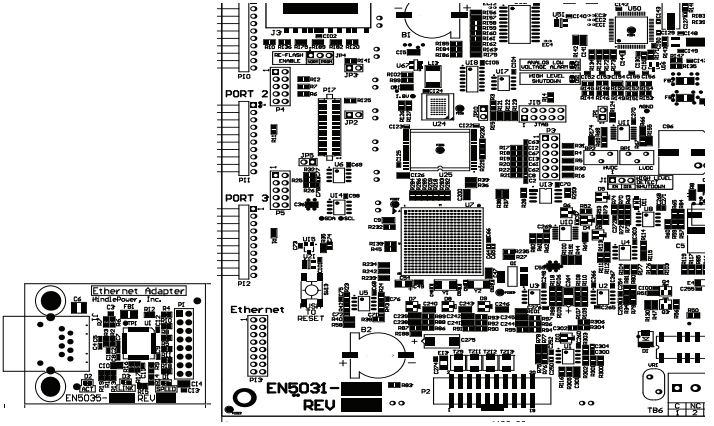
3.2 Ethernet Communications Adapter

ATevo Communications can accept an optional Ethernet Adapter (A22) pc board. The adapter features a standard RJ-45 plug, and will handle copper 10/100 Mbps Ethernet connections. It supports multiple protocols (DNP3 and Modbus) simultaneously.

3.2.1 Ethernet Adapter Installation

- For an enhanced version of these installation steps, refer to Service Instruction (JD5008-50).

The Ethernet Adapter (A22) plugs into the '**Ethernet**' port (P13), near the bottom-left of the Main Control Board (A1).



To install an Ethernet Communications Adapter:

- Turn off (open) both front panel AC Input (CB1) and DC Output (CB2) Circuit Breakers.
- Allow charger internal voltages to ramp down.
- ATevo display will go blank, and all LEDs will be off.
- Open the ATevo front panel door.
- Remove the ground connection from the lower-left corner of the Main Control Board (A1).

- Carefully disengage the Main Control Board (A1) from the left side standoffs.
- Locate the '**Ethernet**' Adapter connection port (P13), near the bottom-left of the Main Control Board (A1).
- Carefully slide socket (P1) of the Ethernet Adapter onto the pins of connection port (P13) on the Main Control Board.
- Hold the Ethernet Adapter (A22) at an angle, to clear standoffs on the back of the door.
- Once the Ethernet Adapter socket is fully engaged on the Main Control Board header pins, line up the holes on the Ethernet Adapter (A22) with the plastic standoff pins.
- Press down on **both** the Ethernet Adapter (A22) and the Main Control Board (A1) to lock them onto the standoffs.
- Replace the ground connection on the bottom-left side of the Main Control Board.
- Close the ATevo front panel door.
- Turn on (close) the AC Input Circuit Breaker (CB1).
- Turn on (close) the DC Output Circuit Breaker (CB2).
- The Ethernet Adapter (A22) hardware is now installed.
- Refer to Section 4.2 to assign protocol and set communications parameters (IP address, Netmask, Gateway, etc).

3.2.2 Ethernet Defined

Ethernet is a family of computer networking technologies used in local area networks (LANs). Several variants of Ethernet are available. Newer variants typically use copper twisted-pair or fiber optic links with hubs or switches to form the network. Ethernet permits a large number of devices to be interconnected and allows the devices to communicate via multiple protocols concurrently.

3.2.3 Ethernet Connections

ATevo Communications can be connected to a 10/100 Mbps Ethernet network with a standard Ethernet RJ-45 cable. Plug one end of the cable into J1 of the Ethernet Adapter (A22) and the other end into an Ethernet hub, switch or directly into the SCADA master.

3.2.4 Optional Fiber Ethernet Interface

Although Ethernet interfaces are standardized, many variants of Ethernet over fiber exist (75 at the time this manual was written). The variants are based on different data rates, fiber type, wavelength, and connector types.

The optional ATevo Fiber Ethernet Interface can be configured to accommodate most if not all of these variants. Due to the vast number of variants (and continuous addition of new ones), the specific offerings and capabilities needed to interface a site fiber Ethernet network must be verified with an ATevo distributor.

ATevo Fiber Ethernet Interface Options	
Interface p/n	**Supplemental Documentation**
EJ5284-5#	Fiber Ethernet Converter (Style-5054 / Style-5070 enclosures)
EJ5284-6#	Fiber Ethernet Converter (Style-5030 enclosure)
EJ5284-7#	Fiber Ethernet Converter (Style-163 / Style-198 enclosures)

With this option (ordering p/n EJ5284-##) a supplemental third-party Fiber-to-Ethernet Converter (A23) is installed into ATevo for user communications. The Converter (A23) is connected to the ATevo Ethernet Adapter (A22) via standard Cat 5 plug-in cabling. A separate 12V power supply (A24) runs off ATevo dc output (+/-).

An assembly overview (JA5109-50) for ATevo Fiber Ethernet communications is supplied with this installed option. However, support for the third party Fiber-to-Ethernet Converter (A23) is controlled by the converter supplier (not ATevo manufacturer).

In addition to the Converter (A23), a user-specified Small-Form Pluggable Module (SFPM) is also supplied. This module is inserted into the A23 Converter, and a manufacturer's cut sheet is supplied for vendor SFPM specifications.

NOTICE *These SFPMs vary, and should be specified with supplier before ordering of the EJ5284-5# option. If a different module is required than the one supplied, please contact the ATevo manufacturer for a replacement.*

4.0 How to Configure Comm Adapters

To configure either Serial Comm or Ethernet Adapters, select:

MENU > COMMUNI-CATION

ATevo will display the ports that may be configured.

To change settings for an adapter, do the following:

- Navigate to it using UP and DOWN.
- Select it with EDIT/ENTER.
- Press UP and DOWN to navigate to parameter to configure.
- Press EDIT/ENTER to select parameter.
- For numbers, use LEFT and RIGHT to navigate to digit to edit, then UP and DOWN to change digit value, then EDIT/ENTER to store new value.
- If options presented, use UP and DOWN to select.
- Select EDIT/ENTER to store new option.

As discussed in Section 3.3.3 of the main ATevo Operating & Service Instructions manual, all commands in this manual are presented with a shorthand communication:

Command > Command > Command

This sample omits navigation buttons like UP, LEFT, and ENTER.

4.1 Serial Communications Configuration

Before configuring the ATevo Serial Communications Adapters, refer to Section 3.1 to make sure the hardware jumper settings on the cards are correct for your application.

NOTICE *A Serial Communications Adapter must be installed in the associated PORT in order for that port to be operational. Any PORT without a Serial Communications Adapter must be set up as 'Unconfigured' (appears as 'none'). See Section 3.1.1 for details on installing communications adapters.*

4.1.1 Assigning PORT Protocol

When configuring a PORT, set the protocol first. If a serial PORT is not assigned a protocol, '(none)' will appear next to the PORT name.

If the Serial PORT is already assigned a protocol, see Section 4.1.2 for instructions on how to change the PORT configuration.

To assign a protocol to an unassigned serial PORT:

MENU > COMMUNICATION (as shown in Section 4.0) > select unassigned port > any key > select protocol

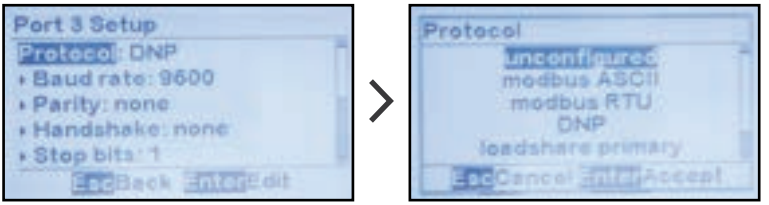
4.1.2 Changing Common PORT Parameters

Several serial PORT configuration parameters are used by all protocols. Other parameters are used only by specific protocols. This section specifies configuration of parameters used by all protocols.

NOTICE *First assign protocol to port per Section 4.1.1.*

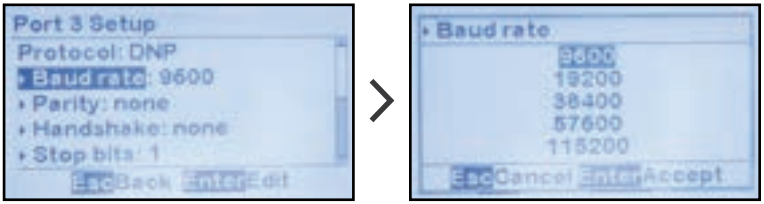
To change the protocol assigned to a port:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with assigned protocol > 'Protocol:' > select from choices



To change Baud Rate:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with assigned protocol > 'Baud rate:' > select from choices

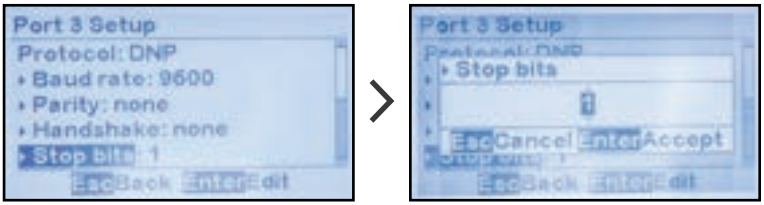


To change parity:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with assigned protocol > 'Parity:' > select from choices

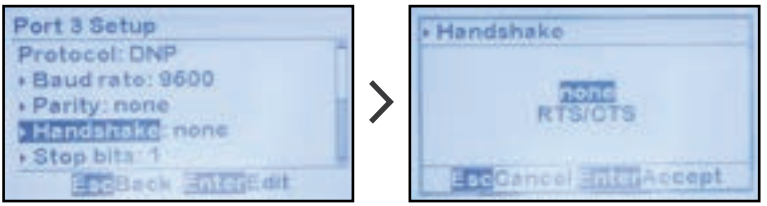
To change the number of STOP bits:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with assigned protocol > 'Stop bits:' > change digits



To change handshake setting:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with assigned protocol > 'Handshake:' > select from choices



NOTICE *It is strongly suggested that Handshake be set to 'none'. Handshaking is never used in RS-485 applications, and it is rarely used in RS-232 applications. It was used years ago with older dial-up modems.*

4.1.3 Changing Modbus Serial PORT Parameters

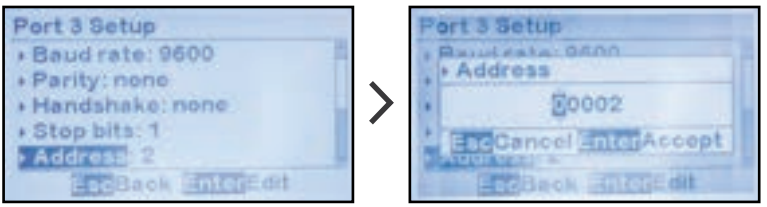
This section details how to change serial port configuration parameters used by Modbus protocol. Refer to Section 4.1.2 to change parameters common to all protocols.

NOTICE *Modbus must have already been assigned as port's protocol per Section 4.1.1 or 4.1.2.*

Modbus protocols require a unique device ID address from 1 to 247.

To change the Modbus ID address:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with 'Modbus' protocol > 'Address:' > set digits



4.1.4 Changing DNP3 Serial PORT Parameters

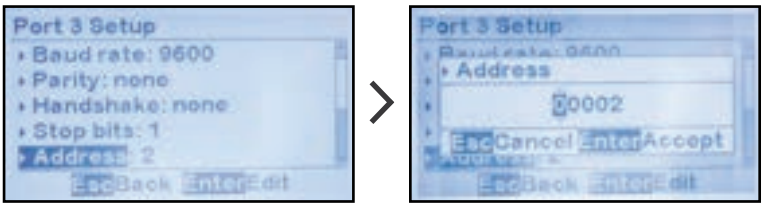
This section details how to change serial port configuration parameters used by the DNP3 protocol. Refer to Section 4.1.2 to change parameters common to all protocols.

NOTICE *DNP must have already been assigned as port's protocol per Section 4.1.1 or 4.1.2.*

DNP3 protocol requires a unique device source address from 1 to 65535 and specific configuration parameters associated with the unsolicited response feature.

To change the DNP source address:

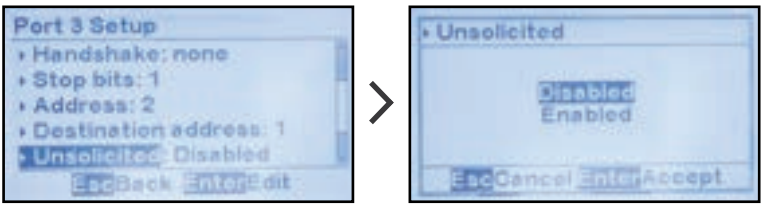
MENU > COMMUNICATION (as shown in Section 4.0) > select port with 'DNP' protocol > 'Address:' > change digit



To enable or disable DNP unsolicited responses:

MENU > COMMUNICATION (as shown in Section 4.0) > select port with 'DNP' protocol > 'Unsolicited:' > select option

NOTICE *Unsolicited responses are rarely used in DNP protocols. Before enabling unsolicited responses check with the network administrator to make sure the network is capable of supporting DNP unsolicited responses.*



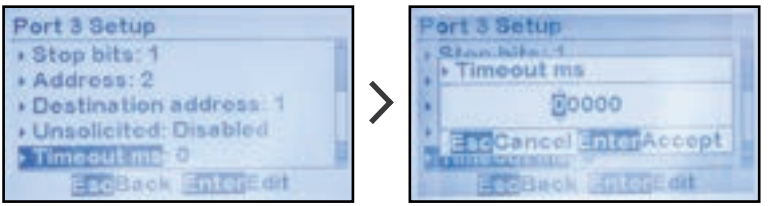
NOTICE *The remaining DNP parameters are only used when DNP unsolicited responses are enabled.*

To change DNP unsolicited response destination address:

MENU > COMMUNICATION (as shown in Section 4.0) > select port using 'DNP' protocol where unsolicited responses are enabled > 'Destination address:' > change digits

To change DNP unsolicited response acknowledgment timeout:

MENU > COMMUNICATION (as shown in Section 4.0) > select port using 'DNP' protocol where unsolicited responses are enabled > 'Timeout ms:' > change digits (value is in milliseconds)



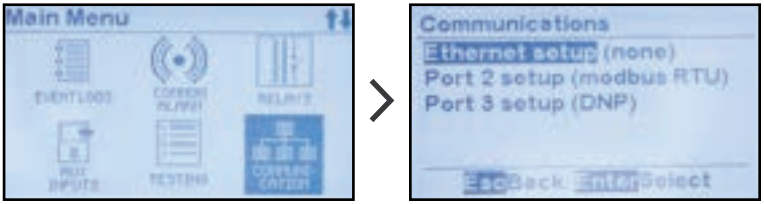
To change DNP number of unsolicited response retries:

MENU > COMMUNICATION (as shown in Section 4.0) > select port using 'DNP' protocol where unsolicited responses are enabled > 'Retries:' > change digits

4.2 Ethernet Communications Configuration

To change or verify the ATevo Ethernet Adapter Configuration:

MENU > COMMUNICATION > 'Ethernet setup'



If '(none)' appears after 'Ethernet setup' , the Ethernet Adapter will need to be enabled according to instructions in Section 4.2.1.

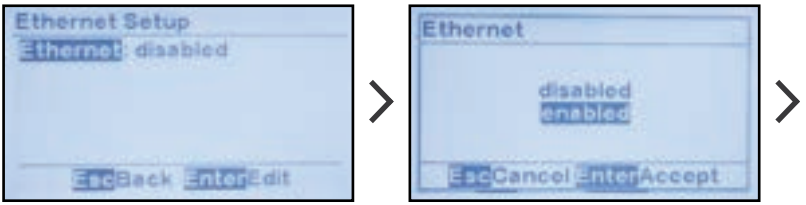
NOTICE *An Ethernet Communications Adapter (A22) is required for Ethernet communications to be operational. If one is not installed, the Ethernet configuration must be set to 'disabled' (appears as 'none'). See Section 3.2.1 for details on installing communications adapters.*

4.2.1 Enabling Ethernet Adapter

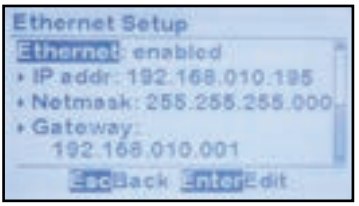
The first step in configuring the Ethernet Adapter is to enable it.

To enable the Ethernet Adapter:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'enabled'



Ethernet configuration parameters will now appear. Refer to Sections 4.2.2 to 4.2.6 for how to configure remaining Ethernet parameters.



4.2.2 Changing Common Ethernet Parameters

Several Ethernet configuration parameters are used by all protocols. Other parameters are used only by specific protocols. This section specifies configuration of parameters used by all protocols.

NOTICE *The Ethernet Adapter (A22) must have been enabled per Section 4.2.1.*

To change the IP address:

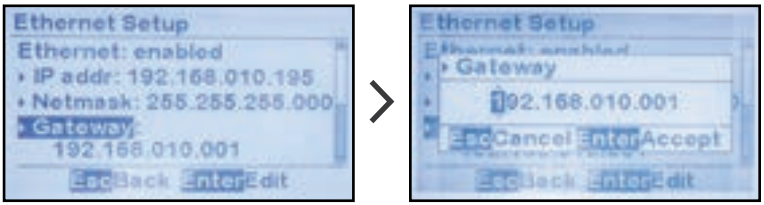
MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'IP addr:' > change digits

To change the 'Netmask:' selection:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Netmask:' > change digits

To change the 'Gateway Address':

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Gateway:' > change digits



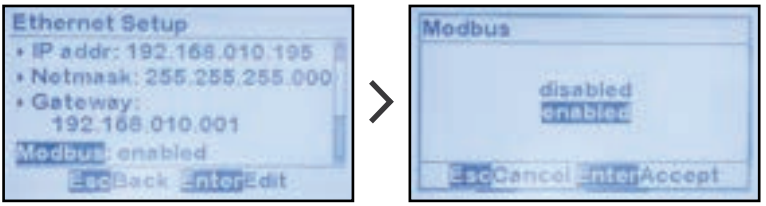
4.2.3 Enable/Disable Modbus Comm via Ethernet

The ATevo Ethernet Adapter (A22) is capable of communicating via multiple protocols simultaneously.

After enabling the Ethernet Adapter and checking common parameter configuration (Sections 4.1.1-4.2.2), you may enable/ disable Modbus communications:

To enable or disable Modbus communications via Ethernet:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Modbus:' > select 'enable' or 'disable'



4.2.4 Configuring Modbus Ethernet Parameters

Modbus Ethernet protocol requires configuration of the following specific parameters:

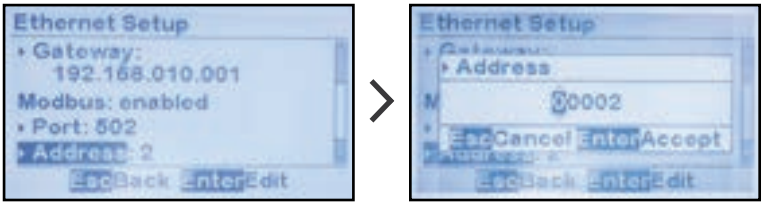
To change the Modbus Ethernet Port number:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Port:' (located after 'Modbus: enabled') > change digits

NOTICE *Default Modbus Ethernet Port is 502. It is highly recommended that this port number not be changed.*

To change the Modbus ID address for the Ethernet interface:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Address:' (located after 'Modbus: enabled') > change digits



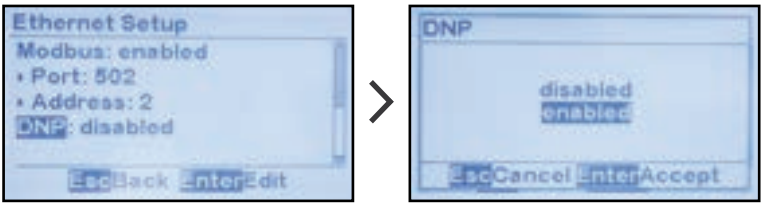
4.2.5 Enable/Disable DNP Comm via Ethernet

The ATevo Ethernet Adapter (A22) is capable of communicating via multiple protocols simultaneously.

After enabling the Ethernet Adapter and checking common parameter configuration (Sections 4.1.1-4.2.2), you may enable/disable DNP communications:

To enable or disable DNP communications via Ethernet:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'DNP:' > select 'enable' or 'disable'

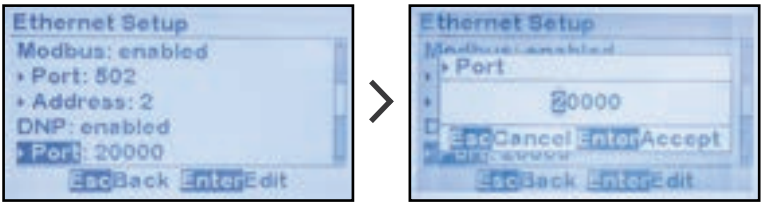


4.2.6 Configuring DNP Ethernet Parameters

DNP Ethernet protocol requires configuration of the following DNP-specific parameters:

To change DNP Ethernet Port number:

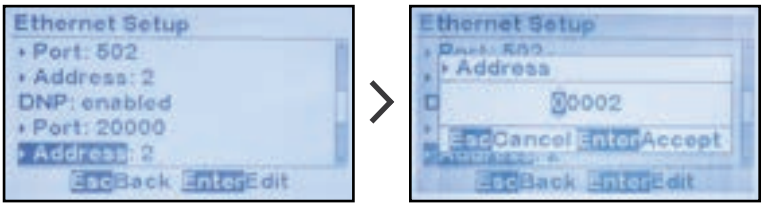
MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Port:' (located after 'DNP: enabled') > change digits



NOTICE *Default DNP Ethernet Port is 20000. It is highly recommended that this port number not be changed.*

To change DNP source address for the Ethernet interface:

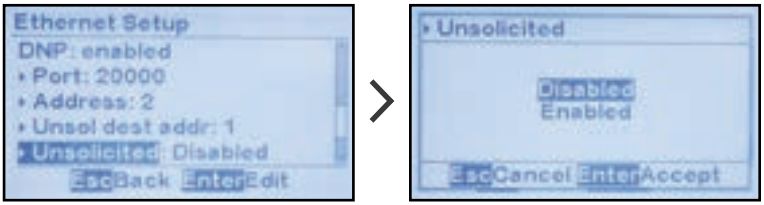
MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Address:' (located after 'DNP: enabled') > change digits



To enable or disable DNP unsolicited responses for the Ethernet interface:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Unsolicited:' (located after 'DNP: enabled') > select 'enabled' or 'disabled'

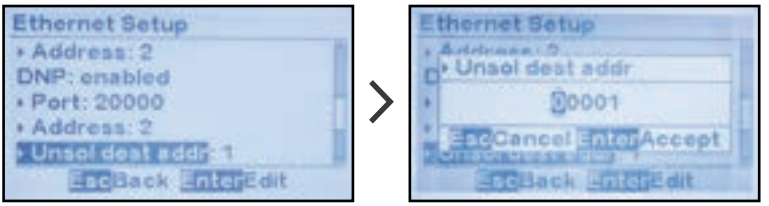
NOTICE *Unsolicited responses are rarely used in DNP protocols. Before enabling unsolicited responses check with network administrator to make sure network is capable of supporting DNP unsolicited responses.*



NOTICE *Remaining DNP parameters are only used when Ethernet DNP unsolicited responses are enabled.*

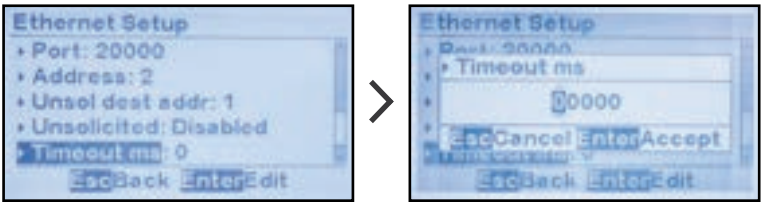
To change DNP unsolicited response destination address:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Unsol dest addr:' (located after 'DNP: enabled') > change digits



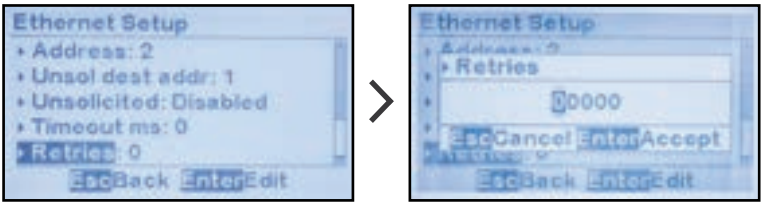
To change DNP unsolicited response acknowledgment timeout:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Timeout ms:' (located after 'DNP: enabled') > change digits



To change DNP number of unsolicited response retries for the Ethernet interface:

MENU > COMMUNICATION > 'Ethernet setup' (as shown in Section 4.2) > 'Retries:' (located after 'DNP: enabled') > change digits



5.1 Introduction

This section provides specifics for implementing DNP3 Level 2 protocol via the ATevo Communications Adapters. In conjunction with the DNP3 Basic 4 Document Set, and the DNP Subset Definitions Document, it provides complete information on how to communicate to the battery charger via the DNP3 interface.

This implementation of DNP3 is fully compliant with DNP3 Subset Definition Level 2, contains many Subset Level 3 features, and contains some functionality beyond Subset Level 3.

5.2 Device Profile Document

The following table provides a 'Device Profile Document' in the standard format defined in the DNP3 Subset Definitions Document. This table should provide a complete interoperability/configuration guide for the DNP3 interface on the ATevo Serial Communications (A12) and Ethernet (A22) Adapters, in combination with the following two (2) items:

- Implementation Table - Section 5.3
- Point List Tables - beginning of Section 5.4

DNP3 Device Profile Document			
Vendor Name: HindlePower, Inc. - 1075 Saint John Street - Easton, PA 18042			
Device Name: ATevo Communications Modules			
Highest DNP Level Supported		Device Function	
For Request	Level 2	-	Master
For Responses	Level 2	✓	Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):			
Maximum Data Link Frame Size (octets)		Maximum Application Fragment Size (octets)	
Transmitted	292	Transmitted	2048
Received	292	Received	2048
Maximum Data Link Re-tries		Maximum Application Layer Re-tries	
✓	None	✓	None
-	Fixed at 3	-	Configurable
-	Configurable range 0 - 255		

continued on next page...

DNP3 Device Profile Document *(continued)*

Requires Data Link Confirmation...	
✓	Never
-	Always
-	Sometimes
-	Configurable
Requires Application Layer Confirmation...	
-	Never
-	Always
✓	When reporting event data
-	When sending multi-fragment responses
-	Sometimes
-	Configurable

Timeouts While Waiting For...								
Data Link Confirm	-	None	✓	Fixed @ 2000	-	Variable	-	Configurable
Complete Appl. Fragment	✓	None	-	Fixed @ _____	-	Variable	-	Configurable
Application Confirm	-	None	✓	Fixed @ 2000	-	Variable	-	Configurable
Complete Appl. Response	✓	None	-	Fixed @ _____	-	Variable	-	Configurable

Others		
Inter-character Timeout	✓	Fixed @ 50ms
Select/Operate Arm Timeout	✓	Fixed @ 5000ms
Binary Input Change Scanning Period	✓	Fixed @ 5000ms
Analog Input Change Scanning Period	✓	Fixed @ 5000ms
Unsolicited Offline Interval	✓	Fixed @ 30000 ms if unsolicited responses is off. Configurable if unsolicited responses is on. See setup.
Unsolicited Response Notification Delay	✓	Fixed @ 15000ms
Delay Measurement		100ms
Synchronization		1000ms

DNP3 Device Profile Document *(continued)*

Sends/Executes Control Operations												
WRITE Binary Outputs		Never	✓	Always		Sometimes		Configurable
SELECT/OPERATE		Never	✓	Always		Sometimes		Configurable
DIRECT OPERATE		Never	✓	Always		Sometimes		Configurable
DIRECT OPERATE - NOACK		Never	✓	Always		Sometimes		Configurable
Count >1	✓	Never		Always		Sometimes		Configurable
Pulse On	✓	Never		Always		Sometimes		Configurable
Pulse Off	✓	Never		Always		Sometimes		Configurable
Latch On		Never	✓	Always		Sometimes		Configurable
Latch Off		Never		Always	✓	Sometimes		Configurable
Queue	✓	Never		Always		Sometimes		Configurable
Clear Queue	✓	Never		Always		Sometimes		Configurable

Explanation of Sometimes: See the Binary Outputs point list in Section **5.4.2**

Reports Binary Input Change Events when no specific variation requested		Reports time-tagged Binary Input Change Events when no specific variation requested	
	Never		Never
✓	Only time-tagged	✓	Binary Input Change With Time
	Only non-time-tagged		Binary Input Change With Relative Time
	Configurable		Configurable (attach explanation)

Sends Unsolicited Responses		Sends Static Data in Unsolicited Responses:	
	Never	✓	Never
✓	Configurable, See DNP configuration section		When Device Restarts
	Only certain objects		When Status Flags Change
	Sometimes (attach explanation)	No other options are permitted.	
✓	ENABLE/DISABLE UNSOLICITED Function codes supported		

Default Counter Object/Variation		Counters Roll Over at:	
✓	No Counters Reported	✓	No Counters Reported
	Configurable		Configurable (attach explanation)
	Default Object: 20 and 21		16 Bits
	Default Variation		32 Bits
	Point-by-point list attached		Other Value:_____
			Point-by-point list attached

Sends Multi-Fragment Responses	
✓	Yes
	No

continued on next page...

DNP3 Device Profile Document *(continued)*				
Sequential File Transfer Support				
Append File Mode		Yes	✓	No
Custom Status Code Strings		Yes	✓	No
Permission Field		Yes	✓	No
File Events Assigned to Class		Yes	✓	No
File Events Poll Specifically		Yes	✓	No
File Events Send Immediately		Yes	✓	No
Multiple Blocks in a Fragment		Yes	✓	No
Max Number of Files Open	0			

5.3 Implementation Table

The table on the following page identifies the variations, function codes, and qualifiers supported by the ATevo Communications Adapter in both request messages and in response messages.

For some table entries, one of the following notes may apply:

Note 1:
The Default variation refers to the variation in the response when the requested variation is '0' or in response to a class 0, 1, 2, or 3 request.

Note 2:
For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a specific request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. For change event objects, qualifiers 17 or 28 are always responded except for object 70, which responds with qualifier 1B or 5B.

Note 3:
For the ATevo Communications Modules, a cold restart is implemented as a warm restart. The executable is not restarted, but the DNP process is restarted.

Note 4:
Writes of Internal Indications are only supported for index 7 (Restart IIN1-7), and indicates 16 and beyond (user-defined indications).

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
1	0	Binary Input (Variation 0 is used to request default variation)	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		
			22 (assign class)	07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		
1	1 (default see NOTE 1)	Binary Input	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		
			22 (assign class)	07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		
1	2	Binary Input with Status	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		
			22 (assign class)	07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		
2	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all)	129 (response)	17, 28 (index)
				07, 08 (limited qty)	130 (unsol. resp)	
2	1	Binary Input Changed without Time	1 (read)	06 (no range, or all)	129 (response)	17, 28 (index)
				07, 08 (limited qty)	130 (unsol. resp)	
2	2 (default - see NOTE 1)	Binary Input Change with Time	1 (read)	06 (no range, or all)	129 (response)	17, 28 (index)
				07, 08 (limited qty)	130 (unsol. resp)	

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
10	0	Binary Output Status (Variation 0 is used to request default variation)	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		
				07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		
10	2 (default see NOTE 1)	Binary Output Status	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		
				07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		
12	1	Control Relay Output Block	3 (select)	00,01 (start-stop)	129 (response)	echo of request
			4 (operate)	07,08 (limited qty)		
			5 (direct op)	17,28 (index)		
			6 (dir. op, noack)			
30	0	Analog Input (variation 0 is used to request default variation)	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-Stop)
				06 (no range, or all)		
			22 (assign class)	07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		
30	1	32-bit Analog Input	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-Stop)
				06 (no range, or all)		
			22 (assign class)	07,08 (limited qty)		17,28 (index - see NOTE 2)
				17,28 (index)		

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
30	2 default - see NOTE 1)	16-bit Analog Input	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-Stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
			22 (assign class)	07,08 (limited qty)		
				17,28 (index)		
30	3	32-bit Analog Input without Flag	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-Stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
			22 (assign class)	07,08 (limited qty)		
				17,28 (index)		
30	4	16-bit Analog Input without Flag	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-Stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
			22 (assign class)	07,08 (limited qty)		
				17,28 (index)		
32	0	Analog Change Event (variation 0 is used to request default variation)	1 (read)	06 (no range or call)	129 (response)	17,28 (index)
				07,08 (limited qty)	130 (unsol. resp)	
32	1	32-bit Analog Change Event without Time	1 (read)	06 (no range or call)	129 (response)	17,28 (index)
				07,08 (limited qty)	130 (unsol. resp)	
32	2 (default - see NOTE 1)	16-bit Analog Change Event without Time	1 (read)	06 (no range or call)	129 (response	17,28 (index)
				07,08 (limited qty)	130 (unsol. resp)	

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
32	3	32-bit Analog Change Event with Time	1 (read)	06 (no range or call)	129 (response)	17,28 (index)
				07,08 (limited qty)	130 (unsol. resp)	
32	4	16-bit Analog Change Event with Time	1 (read)	06 (no range or call)	129 (response)	17,28 (index)
				07,08 (limited qty)	130 (unsol. resp)	
34	0	Analog Input Reporting Deadband (variation 0 is used to request default variation)	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
34	1 (default see NOTE 1)	16-bit Analog Input Reporting Deadband	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
			2 (write)	00,01 (start-stop)		
				07,08 (limited qty)		
				17,28 (index)		
34	2	16-bit Analog Input Reporting Deadband	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
			2 (write)	00,01 (start-stop)		
				07,08 (limited qty)		
				17,28 (index)		

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
40	0	Analog Output Status (variation 0 is used to request default variation)	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
40	1	32-bit Analog Output Status	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
40	2 (default - see NOTE 1)	16-bit Analog Output Status	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
41	1	32-bit Output Block	3 (select)	00,01 (start-stop)	129 (response)	echo of request
			4 (operate)			
			5 (direct op)	07,08 (limited qty)		
			6 (dir. op, noack)	17,28 (index)		
41	2	16-bit Output Block	3 (select)	00,01 (start-stop)	129 (response)	echo of request
			4 (operate)			
			5 (direct op)	07,08 (limited qty)		
			6 (dir. op, noack)	17,28 (index)		
50	0	Time and Date	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
50	1 (default - see NOTE 1)	Time and Date	1 (read)	00,01 (start-stop)	129 (response)	00,01 (start-stop)
				06 (no range, or all)		17,28 (index - see NOTE 2)
				07,08 (limited qty)		
				17,28 (index)		
			2 (write)	00,01 (start-stop)	129 (response)	
				06 (no range, or all)		
				07 (limited qty=1)		
				08 (limited qty)		
				17,28 (index)		
60	1	Class 0, Data	1 (read)	06 (no range, or all)	129 (response)	00,01 (start-stop)
			22 (assign class)			
60	2	Class 1 Data	1 (read)	06 (no range, or all)	129 (response)	17,28 (index - see NOTE 2)
				07,08 (limited qty)		
			20 (enbl. unsol.)	06 (no range, or all)		
			21 (dsbl. unsol.)			
			22 (assign class)			
60	3	Class 2 Data	1 (read)	06 (no range, or all)	129 (response)	17,28 (index - see NOTE 2)
				07,08 (limited qty)		
			20 (enbl. unsol.)	06 (no range, or all)		
			21 (dsbl. unsol.)			
			22 (assign class)			

Implementation Table

Color Key	Indicates Subset Level 3 Functionality (Beyond Level 2)	Indicates Functionality Beyond Subset Level 3

Object			Request (library parse)		Response (library will respond with)	
60	4	Class 3 Data	1 (read)	06 (no range, or all)	129 (response)	17,28 (index - see NOTE 2)
				07,08 (limited qty)		
			20 (enbl. unsol.)	06 (no range, or all)		
			21 (dsbl. unsol.)			
			22 (assign class)			
No Object (function code only) - See Note 3			13 (Cold Restart)			
No Object (function code only)			14 (Warm Restart)			
No Object (function code only)			23 (Delay Meas.)			

5.4 DNP Point Lists

The tables in the following sections identify all the individual data points provided by this implementation of DNP3.

5.4.1 Binary Input Points

The following table lists Binary Inputs (Object 1).

Binary Input Points			
Static (Steady-State) Object Number		**1**	
Change Event Object Number		**2**	
Request Function Codes supported:		**1 (read)**	
		22 (assign class)	
Static Variation reported when variation 0 requested:		**1 (Binary Input without status)**	
Change Event Variation reported when variation 0 requested:		**2 (Binary Input Change with Time)**	
Change Event Scan Rate:		**5 seconds**	
Point Index	**Name/Description**	**If Point Status is Logic '1'**	**Initial Event Class**
0	High Voltage DC (HVDC) Alarm	active	1
1	Low Voltage DC (LVDC) Alarm	active	1
2	DC Output Failure Alarm	active	1
3	No AC Input Alarm (no zero-crossing detected)	active	1
4	Positive [+] Ground Fault Alarm ***Critical***	active	1
5	Negative [-] Ground Fault Alarm ***Critical***	active	1
6	Common Alarm Relay (CAR)	active	1
7	High Voltage DC (HVDC) Shutdown	active	1
8	Low Voltage AC (LVAC) Shutdown (<65% nominal Vac)	active	1
9	Forced Load Sharing Enabled	enabled	1
10	Temperature Compensation (TempCo) Enabled	enabled	1
11	Defective Temperature Probe	defective	1
12	Equalize Mode (0 = float)	equalize	1
13	*(not used)*	-	1
14	*(not used)*	-	1
15	Auto-Equalize Timer	enabled	1
16	HVDC Shutdown Enabled	enabled	1
17	*(not used)*	-	1
18	High Ripple Alarm	active	1
19	End of Discharge Alarm	active	1
20	Rectifier Over Temperature Alarm	active	1
21	DC Circuit Breaker Status	open	1

Binary Input Points *(continued)*			
Point Index	**Name/Description**	**If Point Status is Logic '1'**	**Initial Event Class**
22	External Voltage Sense Fail Alarm	active	1
23	Internal Voltage Sense Fail Alarm	active	1
24	DC Power Supply Alarm	active	1
25	Open DC Output Alarm	active	1
26	High Level Detect Alarm	active	1
27	Low Level Detect Alarm	active	1
28	Low AC Supply Alarm (<75% nominal Vac)	active	1
29	Current Limit Status	active	1
30	High Level Detect (HLD) Shutdown Status	active	1
31	Alarm Relay Failure	active	1
32	Rectifier Temperature Sense Failure	active	1
33	Display / User Interface Processor Failure	active	1
34	Battery Open Alarm	active	1
35	Forced Load Sharing Communication Failure	active	1
36	Forced Load Sharing Independent Mode	active	1
37	Forced Load Sharing Not Ready	active	1
38	Battery Discharging	active	1
39	Battery Overtemp	active	1
40	Vgnd Imbalance ***Warning***	active	1
41	Vgnd Imbalance ***Critical***	active	1
42	Positive [+] Ground Fault ***Warning***	active	1
43	Negative [-] Ground Fault ***Warning***	active	1
44	Dynamic Current Limit	active	1
45	Power Board EEROM Failure	active	1
46	Main EEROM Failure	active	1
47	Hardware Level Detect Digital Potentiometer Failure	active	1
48	Ambient Temperature Probe Failure	active	1
49	Open AC Breaker	active	1
50	AC Meter Option Installed	active	1
51	AC Supply	active	1
52	Low Priority Aggregate Alarm Group	active	1
53	High Priority Aggregate Alarm Group	active	1
-	*future*	-	-

5.4.2 Binary Output Points

The following table lists Binary Outputs (Object 10).

Binary Output Status Points			
Object Number Status		**10**	
Binary Output Status Points		**1 (read)**	
Default Variation reported when variation 0 requested		**2 (Binary Output Status)**	
Control Relay Output Blocks			
Object Number		**12**	
Request Function Codes supported		**3 (select), 4 (operate)**	
		5 (direct operate), 6 (direct operate, noack)	
Point Index	**Name/Description**	**Latch 'OFF'**	**Latch 'ON'**
0	Float / Equalize Mode	float	equalize
1	*(not used)*	-	-
2	*(not used)*	-	-
3	Manual Timer / Auto Equalize Timer	manual	auto
4	HVDC Shutdown	disable	enable
5	*(not used)*	-	-
6	Battery Temperature Compensation (TempCo) Enable	disable	enable
7	Battery Discharge Enable	disable	enable
8	Remote Voltage Sense Enable	disable	enable
9	Auto Run Battery Open Test Enable	disable	enable
10	Battery Open Test Ran	disable	enable
11	Dynamic Current Limit Enable	disable	enable
12	Battery Temperature Probe Enable	disable	enable
-	*future*	-	-

5.4.3 Analog Input Status Points

The following table lists Analog Inputs (Object 30).

It is important to note that 16-bit and 32-bit variations of Analog Inputs, Analog Output Control Blocks, and Analog Output Statuses are transmitted through DNP as signed numbers. Even for analog input points that are not valid as negative values, the maximum positive representation is 32767.

The 'Multiplier' column indicates the value by which each point data is multiplied. Since all data is sent in integer format, floating point numbers are multiplied by a constant (1, 10, or 100) to maintain decimal information. For example, points with two decimal places are multiplied by 100 (5.67 is sent as 567), points with one decimal point of resolution are multiplied by 10 (8.2 is sent as 82). To convert the point data to the correct value, simply divide the point by the 'Multiplier' value.

The 'Default Deadband' column is used to represent the absolute amount by which the point must change before an analog change event will be generated. The 'Default Event Class' column is used to represent the class (1, 2, 3, or none) in which detected change events will be reported. Only default values for these columns are documented here, because values may change in operation due to either local (user-interface) or remote (through DNP) configuration control.

Analog Input Points				
Static (Steady State) Object Number		30		
Change Event Object Number		32		
Reporting Deadband Object Number		34		
Request Function Codes supported		1 (read)		
		2 (write) - deadbands only		
		22 (assign class)		
Static Variation Reported when variation 0 requested		2 (16-bit Analog Input)		
Change Event Variation Reported when variation 0 requested		2 (Analog Change Event without Time)		
Reported Deadband Variation Reported when variation 0 requested		1 (16-bit Reporting Deadband)		
Change Event Scan Rate		5 seconds		
Point Index	Name/Description	Multiplier (format)	Default Deadband	Default Event Class
0	Display / User Interface Processor Firmware Rev	1 (XXX.xxx.0)	1	2
1	DNP Firmware Rev	1 (XXX.xxx.0)	1	2
2	Main ATevo Processor Firmware Rev	1 (XXX.xxx.0)	1	2
3	ATevo Model Nominal Output Voltage Rating (Vdc)	1 (XXX)	1	2
4	ATevo Model Nominal Output Current Rating (Adc)	1 (XXX)	1	2
5	Charger DC Output Voltage (volts)	10 (XXX.X)	10	2
6	Charger DC Output Current (amperes)	10 (XXX.X)	20	2
	continued on next page...			

Analog Input Points *(continued)*				
Point Index	Name/Description	Multiplier (format)	Default Deadband	Default Event Class
7	Equalize Time Remaining (minutes)	1 (XXXX)	1	2
8	*(not used)*	1 (XXXXX)	1	2
9	Battery Temperature (°C)	10 (XXX.X)	1	2
10	Rectifier Temperature (°C)	10 (XXX.X)	1	2
11	Vgnd Imbalance Lean (1 - pos[+] > 5%, 2 - neg[-] > 5%, 0 - less than 5%)	1 (X)	1	2
12	Positive [+] Terminal to Ground	1 (XXXXX)	1	2
13	Negative [-] Terminal to Ground	1 (XXXXX)	1	2
14	Vgnd Imbalance (Vdc)	10 (XXX.X)	1	2
15	Resistance to Ground (kΩ) (1 - pos[+] to gnd, 2 - neg[-] to gnd, 0 - invalid)	1 (X)	1	2
16	Loadshare Enabled (1 - primary, 2 - secondary, 0 - not enabled)	1 (X)	1	2
17	Battery Open Test Timestamp Low (seconds since January 1, 2000)	1 (XXXXX)	1	2
18	Battery Open Test Timestamp High (seconds since January 1, 2000)	1 (XXXXX)	1	2
19	Ambient Temperature (°C)	10 (XXX.X)	1	2
20	Heartbeat	1 (XXXXX)	1	2
21	AC Input Voltage - Phase A (Vac)	10 (XXXX.X)	1	2
22	AC Input Voltage - Phase B (Vac)	10 (XXXX.X)	1	2
23	AC Input Voltage - Phase C (Vac)	10 (XXXX.X)	1	2
24	AC Input Current - Phase A (Aac)	10 (XXXX.X)	1	2
25	AC Input Current - Phase B (Aac)	10 (XXXX.X)	1	2
26	AC Input Current - Phase C (Aac)	10 (XXXX.X)	1	2
27	AC Line Frequency (Hz)	100 (XXX.XX)	1	2
28	Battery Current (Adc)	10 (XXXX.X)	1	2
-	*future*	-	-	-

NOTICE *Firmware revision format (XXX.xxx.0) represents Major Version.Minor Version.0.*

- **Upper 8 bits of register value are the Major Version**
- **Lower 8 bits of register value are the Minor Version**
- **Example: Version 10.6.0 would be 0x0A06 (hex) = 2566 (decimal)**

5.4.4 Analog Output Status Points

The following table lists Analog Outputs (Object 40). The valid range for many of these points depends on ATevo battery charger model (Vdc - Adc rating). To determine valid ranges of these set points, refer to user supplement (JA5124-02). It is important to note that 16-bit and 32-bit variations of Analog Inputs, Analog Output Control Blocks, and Analog Output Statuses are transmitted through DNP as signed numbers. Even for analog input points that are not valid as negative values, the maximum positive representation is 32767.

The 'Multiplier' column indicates the value by which each point data is multiplied. Since all data is sent in integer format, floating point numbers are multiplied by a constant (1, 10, or 100) to maintain decimal information. For example, points with two decimal places are multiplied by 100 (5.67 is sent as 567), points with one decimal point of resolution are multiplied by 10 (8.2 is sent as 82). To convert the point data read to the correct value, simply divide the point by the 'Multiplier' value.

When writing a value to the Analog Output, you must multiply the desired value by the constant in the 'Multiplier' column. For example, if you want to change the 'Float Voltage Set Point' to 132 Vdc, you need to write 1320 to Analog Output '0' (132 X 10 = 1320), where '10' is the multiplier for Analog Output Point '0'.

The 'Valid Range' column lists the possible values, which can be successfully written to the associated Analog Output point. This is the true value, and does not include the additional multiplier correction. Attempting to write values outside of this range will result in a DNP3 error response.

Analog Output Status Points			
Object Number		**40**	
Request Function Codes Supported		**1 (read)**	
Default variation reported when variation 0 requested		**2 (16-bit Analog Input)**	
Analog Output Blocks			
Object Number		**41**	
Request Function Codes supported		**3 (select), 4 (operate)**	
		5 (direct operate), 6 (direct operate, noack)	
Point Index	**Name/Description**	**Multiplier (format)**	**Valid Range**
0	Float Voltage Set Point (Vdc)	10 (XXX.X)	see JA5124-02
1	Equalize Voltage Set Point (Vdc)	10 (XXX.X)	see JA5124-02
2	Equalize Timer Set Point (hours)	1 (XX)	1 <= XX <= 99
3	Current Limit Set Point (Adc)	10 (XXX.X)	see JA5124-02
4	High Voltage DC Alarm Set Point (Vdc)	10 (XXX.X)	see JA5124-02
5	Low Voltage DC Alarm Set Point (Vdc)	10 (XXX.X)	see JA5124-02
6	High Level Detect Set Point (Vdc)	10 (XXX.X)	see JA5124-02
7	Low Level Detect Set Point (Vdc)	10 (XXX.X)	see JA5124-02
8	End of Discharge Set Point (Vdc)	10 (XXX.X)	see JA5124-02
9	AC Ripple Alarm Set Point (mV)	1 (XXX)	50 < XXX < 500 (in 5mV steps)
10	Ground Fault ***Warning*** Set Point (kΩ) (shared value for both pos[+] & neg[-] fault)	1 (XX)	10K <= XX <= 40K (in 1 kΩ steps)
11	Ground Fault ***Warning*** Set Point (kΩ) (mirrored point index 10)	1 (XX)	10K <= XX <= 40K (in 1kΩ steps)
12	Battery Type (chemistry)	1 (X)	0 - lead acid, 1 - NiCd
13	Charger Mode Setting	1 (X)	0 - shutdown, 1 - battery open test, 2 - float, 3 - timed equalize
14	Ground Fault ***Critical*** Set Point (kΩ)	1 (XX)	1 <= X <= 50
15	Vgnd Imbalance ***Warning*** Set Point (Vdc)	1 (XX)	see JA5124-02
16	Vgnd Imbalance ***Critical*** Set Point (Vdc)	1 (XX)	see JA5124-02
17	Battery Overtemp Set Point (°C)	10 (XX.X)	30 <= XX <= 60
18	Battery Open Test Frequency (days)	1 (XXX)	1 <= X <= 180
19	Battery Open Test Duration (minutes)	1 (X)	1 <= X <= 8
20	Battery Open Test Set Point (Vdc)	1 (XXX)	see JA5124-02
21	Date/Time Low (seconds since January 1, 2000)	1 (XXXXX)	lower 16-bits
22	Date/Time High (seconds since January 1, 2000)	1 (XXXXX)	upper 16-bits
-	*future*	-	-

5.4.5 Internal Indication (IIN) Bits

The following Internal Indication bits are defined by the DNP3 protocol.

Internal Indication Bits		
Object Number		**80**
Request Function Codes Supported		**1 (read), 2 (write)**
Default Variation reported when variation 0 requested		
Point Index	**Descriptions and Conditions**	**Writable?**
0	IIN1-0 All Stations - set after a broadcast message (any me sage using a destination address of 0xfff0 or above) has been received. Does not indicate an error condition.	No
1	IIN1-1 Class 1 event data available. Can be set at any time and does not indicate an error condition.	No
2	IIN1-2 Class 2 event data available. Can be set at any time and does not indicate an error condition.	No
3	IIN1-3 Class 3 event data available. Can be set at any time and does not indicate an error condition.	No
4	IIN1-4 Time synchronization required. Can be set at any time and does not indicate an error condition.	No
5	IIN1-5 Local mode. Set if some points are uncontrollable via DNP.	No
6	IIN1-6 Device Trouble.	No
7	IIN1-7 Device restart. Set only under specific conditions. Does not indicate an error condition.	Yes
8	IIN2-0 Function Unknown. Generally means that the function code (octet 2 of the request header) cannot be processed.	No
9	IIN2-1 Object Unknown. Generally means that the function code could be processed but the object group / variation could not be processed.	No
10	IIN2-2 Parameter Error. Generally indicates that both the function code and object group / variation could be processed but that the qualifier / range field is in error.	No
11	IIN2-3 Buffer Overflow. Indicates that an event buffer has over-flowed, and that change events, of at least one type, have been lost.	No
12	IIN2-4 Already Executing.	No
13	IIN2-5 Bad configuration.	No
14	IIN2-6 Reserved. Always 0.	No
15	IIN2-7 Reserved. Always 0.	No
-	*future*	-

6.1 Introduction

This section provides specifics for implementing Modbus protocol via the ATevo Communications Adapters. The Modbus protocol was implemented using the Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev. J.

6.2 Supported Function Codes

The following standard Modbus function codes are supported:

- 01 - Read Coil Status
- 02 - Read Input Status
- 03 - Read Holding Registers
- 04 - Read Input Registers
- 05 - Read Single Coil
- 06 - Preset Single Register
- 15 - Force Multiple Coils
- 16 - Preset Multiple Registers

6.3 Modbus Binary Outputs (Coils)

The following table lists the Binary Output registers:

Modbus Binary Outputs			
Address	**Name/Description**	**Status 'OFF' (Logic '0')**	**Status 'ON' (Logic '1')**
00001	Float / Equalize Mode	float	equalize
00002	*(not used)*	-	-
00003	*(not used)*	-	-
00004	Manual Timer / Auto Equalize Timer	manual	auto
00005	HVDC Shutdown	disable	enable
00006	*(not used)*	-	-
00007	Battery Temperature Compensation	disable	enable
00008	Battery Discharge	disable	enable
00009	Remote Sense	disable	enable
00010	Auto Run Battery Open Test	disable	enable
00011	Battery Open Test Ran	disable	enable
00012	Dynamic Current Limit	disable	enable
00013	Battery Temperature Probe	disable	enable
-	*future*	-	-

6.4 Binary Inputs

The following table lists Binary Input Status registers:

Modbus Binary Input Status Registers		
Address	**Name/Description**	**If Status is 'ON' (Logic '1')**
10001	High Voltage DC (HVDC) Alarm	active
10002	Low Voltage DC (LVDC) Alarm	active
10003	DC Output Failure Alarm	active
10004	No AC Input Alarm (no zero-crossing detected)	active
10005	Positive [+] Ground Fault Alarm ***Critical***	active
10006	Negative [-] Ground Fault Alarm ***Critical***	active
10007	Common Alarm Relay (CAR)	active
10008	High Voltage DC (HVDC) Shutdown Active	active
10009	Low Voltage AC (LVAC) Shutdown (<65% nominal Vac)	active
10010	Forced Load Sharing Enabled	enabled
10011	Temperate Compensation (TempCo) Enabled	enabled
10012	Defective Temperate Probe	defective
10013	Equalize Mode (0 = float)	equalize
10014	*(not used)*	-
10015	*(not used)*	-
10016	Auto-Equalize Timer	enabled
10017	HVDC Shutdown Enabled	enabled
10018	*(not used)*	-
10019	High Ripple Alarm	active
10020	End of Discharge Alarm	active
10021	Rectifier Over Temperature Alarm	active
10022	DC Breaker Status	open
10023	External Voltage Sense Fail Alarm	active
10024	Internal Voltage Sense Fail Alarm	active
10025	DC Power Supply Alarm	active
10026	Open DC Output Alarm	active
10027	High Level Detect Alarm	active
10028	Low Level Detect Alarm	active
10029	Low AC Supply Alarm (<75% nominal Vac)	active
10030	Current Limit Status	active
10031	High Level Detect Shutdown Status	active
10032	Alarm Relay Failure	active
	continued on next page...	

Modbus Registers *(continued)*		
Address	**Name/Description**	**If Status is 'ON' (Logic '1')**
10033	Rectifier Temperature Sense Failure	active
10034	Display / User Interface Processor Failure	active
10035	Battery Open Alarm	active
10036	Loadshare Communication Failure	active
10037	Loadshare Independent Mode	active
10038	Loadshare Not Ready	active
10039	Battery Discharging	discharging
10040	Battery Overtemp	=> set point
10041	Vgnd Imbalance ***Warning***	=> set point
10042	Vgnd Imbalance ***Critical***	=> set point
10043	Positive [+] Ground Fault ***Warning***	res to gnd <= set point
10044	Negative [-] Ground Fault ***Warning***	res to gnd <= set point
10045	Dynamic Current Limit	active
10046	Power Board EEROM Failure	failed
10047	Main EEROM Failure	failed
10048	Hardware Level Detect Digital Potentiometer Failure	potentiometer failed
10049	Ambient Temperature Probe Failure	probe failed
10050	Open AC Breaker	tripped
10051	AC Meter Option Installed	installed
10052	AC Supply (1PH or 3PH)	three phase
10053	Low Priority Aggregate Alarm Group	active
10054	High Priority Aggregate Alarm Group	active
-	*future*	-

6.5 Modbus Input Registers

The following table lists the Modbus Input Registers.

For each point, the 'Multiplier' column indicates the value the register data is multiplied by. Since all data is sent in integer format, floating point numbers are multiplied by a constant (1, 10, or 100) to maintain decimal information. For example, registers with two decimal places are multiplied by 100 (5.67 is sent as 567), resisters with one decimal point of resolution are multiplied by 10 (8.2 is sent as 82). To convert the register data to the correct value, simply divide the register value by the 'Multiplier' value.

Modbus Input Status Registers		
Address	**Name/Description**	**Multiplier (format)**
30001	Display / User Interface Processor Firmware Rev	1 (XXX.xxx.0)
30002	Modbus Firmware Rev	1 (XXX.xxx.0)
30003	Main Processor Firmware Rev	1 (XXX.xxx.0)
30004	Model Nominal Output Voltage Rating (Vdc)	1 (XXX)
30005	Model Nominal Output Current Rating (Adc)	1 (XXX)
30006	Charger DC Output Voltage (volts)	10 (XXX.X)
30007	Charger DC Output Current (amperes)	10 (XXX.X)
30008	Equalize Time Remaining (minutes)	1 (XXXX)
30009	*(not used)*	1 (XXXXX)
30010	Battery Temperature (°C)	10 (XXX.X)
30011	Rectifier Temperature (°C)	10 (XXX.X)
30012	Vgnd Imbalance Lean (1 - pos[+] > 5%, 2 - neg[-] > 5%, 0 - less than 5%)	1 (X)
30013	Positive [+] Terminal to Ground	1 (XXXXX)
30014	Negative [-] Terminal to Ground	1 (XXXXX)
30015	Vgnd Imbalance (Vdc)	10 (XXX.X)
30016	Resistance to Ground (kΩ) (1 - pos[+] to gnd, 2 - neg[-] to gnd, 0 - invalid)	1 (X)
30017	Loadshare Enabled (1 - primary, 2 - secondary, 0 - not enabled)	1 (X)
30018	Battery Open Test Timestamp Low (seconds since January 1, 2000)	1 (XXXXX)
30019	Battery Open Test Timestamp High (seconds since January 1, 2000)	1 (XXXXX)
30020	Ambient Temperature	10 (XXX.X)
30021	Heartbeat	1 (XXXXX)
30022	AC Input Voltage Phase A	10 (XXXX.X)
30023	AC Input Voltage Phase B	10 (XXXX.X)
30024	AC Input Voltage Phase C	10 (XXXX.X)
30025	AC Input Current Phase A	10 (XXXX.X)
30026	AC Input Current Phase B	10 (XXXX.X)
30027	AC Input Current Phase C	10 (XXXX.X)
30028	AC Line Frequency	100 (XXX.XX)
30029	Battery Current	10 (XXXX.X)
-	*future*	-

NOTICE *Firmware revision format (XXX.xxx.0) represents Major Version.Minor Version.0.*

- **Upper 8 bits of register value are the Major Version**
- **Lower 8 bits of register value are the Minor Version**
- **Example: Version 10.6.0 would be 0x0A06 (hex) = 2566 (decimal)**

6.6 Modbus Holding Registers

For each point, the 'Multiplier' column indicates the value the register data is multiplied by. Since all data is sent in integer format, floating point numbers are multiplied by a constant (1, 10, or 100) to maintain decimal information. For example, registers with two decimal places are multiplied by 100 (5.67 is sent as 567), resisters with one decimal point of resolution are multiplied by 10 (8.2 is sent as 82). To convert the register data to the correct value, simply divide the register value by the 'Multiplier' value.

When writing a value to a Holding Register, you must multiply the desired value by the constant in the 'Multiplier'. For example, to change the 'Float Voltage Set Point' to 132 Vdc, you would need to write 1320 to Holding Register '40001' (132 X 10 = 1320). The '10' is the multiplier constant listed in 'Multiplier' column for Holding Register '40001'.

The 'Valid Range' column lists the possible values that can be successfully written to the associated Holding Register. This is the true value and does not include the multiplier correction. Attempting to write values outside of this range will result in a Modbus error returned as an Exception Response.

The valid range for many of these points depends on ATevo battery charger model (Vdc - Adc rating). To determine valid ranges of these set points, refer to user supplement (JA5124-02).

The following table lists the Modbus Holding Registers.

Modbus Holding Registers			
Address	**Name/Description**	**Multiplier (format)**	**Valid Range**
40001	Float Voltage Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40002	Equalize Voltage Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40003	Equalize Timer Set Point (hours)	1 (XX)	1 <= XX <= 99
40004	Current Limit Set Point (Adc)	10 (XXX.X)	see JA5124-02
40005	High Voltage DC Alarm Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40006	Low Voltage DC Alarm Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40007	High Level Detect Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40008	Low Level Detect Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40009	End of Discharge Set Point (Vdc)	10 (XXX.X)	see JA5124-02
40010	AC Ripple Alarm Set Point (mV)	1 (XXX)	50 < XXX < 500 (in 5mV steps)
40011	Ground Fault ***Warning*** Set Point (kΩ) (shared value for both pos[+] & neg[-] fault)	1 (XX)	10K <= XX <= 40K (in 1 kΩ steps)
40012	Ground Fault ***Warning*** Set Point (kΩ) (mirrored address 40011)	1 (XX)	10K <= XX <= 40K (in 1 kΩ steps)
40013	Battery Type (chemistry)	1 (X)	0 - lead acid, 1 - NiCd
40014	Charger Mode Setting	1 (X)	0 - shutdown, 1 - battery open test, 2 - float, 3 - timed equalize
40015	Ground Fault ***Critical*** Set Point (kΩ)	1 (XX)	1 <= X <= 50
40016	Vgnd Imbalance ***Warning*** Set Point (Vdc)	1 (XX)	see JA5124-02
40017	Vgnd Imbalance ***Critical*** Set Point (Vdc)	1 (XX)	see JA5124-02
40018	Battery Overtemp Set Point (°C)	10 (XX.X)	30 <= XX <= 60
40019	Battery Open Test Frequency (days)	1 (XXX)	1 <= X <= 180
40020	Battery Open Test Duration (minutes)	1 (X)	1 <= X <= 8
40021	Battery Open Test Set Point (Vdc)	1 (XXX)	see JA5124-02
40022	Date/Time Low (seconds since January 1, 2000)	1 (XXXXX)	lower 16-bits
40023	Date/Time High (seconds since January 1, 2000)	1 (XXXXX)	upper 16-bits
-	*future*	-	-

DOCUMENT NUMBER

The text and graphics contained within this manual are controlled by the manufacturer's internal part number (**JA5127-00**). The revision date of this manual's text and graphics is listed below. These controls supercede all other available dates. The first and last page of this manual are reserved for company-specific front and back cover artwork. Any revision levels, revision dates, or document numbers featured on the first two (2) and last two (2) pages of this manual refer to the cover artwork only.

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PARTS DATA PACKAGE

A job-specific customized Parts Data Package report is supplied with every shipped ATevo battery charger. The data listed in this report supercedes any information featured in product literature, standard documentation, and/or quote documents. The parts and quantities listed are applicable only to the ATevo featuring same serial number listed on the Parts Data Package report.

DRAWINGS

A ***customized*** record drawing package is available for any ATevo, featuring:

- unit-specific drawing list / data nameplate detail
- enclosure outline drawing
- itemized internal component layout
- control panel / pc board detail
- functional electrical schematic with component ratings
- full connection diagram

If the standard drawings featured in this manual are not sufficient, please contact your sales representative for drawing availability from the battery charger manufacturer. Any job-specific custom drawings supplied with an ATevo supercede the standard drawings featured in Appendix B.

ONLINE AVAILABILITY

An ***unbranded*** version of this operating and service instruction manual is available online at **http://www.ATSeries.net/PDFs/JA0102-54.pdf**. Other user documentation for ATevo Series microprocessor-controlled battery chargers and battery charger products is available online at **http://www.ATSeries.net/ATevo/**. Available documentation includes: operating manuals, feature and accessory instructions, standard drawings (including those listed in this manual), field installation and service instructions, and product application notes. Saved in Adobe Acrobat Portable Document Format (***.pdf**), they are ***freely*** available for downloading and printing.

If revision dates differ between the drawings embedded in this manual and the full online PDF drawings, refer to document with the later revision date. For availability of branded documents, and/or standard drawings, please contact your sales representative, or visit the web site listed on the back cover of this manual.

for technical support

refer to the distributor contact information
located in the lower-right corner
of the ***ATevo*** silver data nameplate decal

digital copy of ***this*** manual
(http://www.atseries.net/PDFs/JA0102-54.pdf)