JA5054-50

Installation & Operating Instructions

ATevo Series Battery Charger
FORCED LOAD SHARING

NOTICE   The information listed in this document (p/n JA5054-50) may supercede the text and imagery listed in **Section 13** of the standard ATevo charger manual (p/n **JA0102-5#**). Please compare it to the print date listed in **Appendix C** at the end of the full ATevo *Operating and Service Instructions*.

CONTENTS

INTRODUCTION

Multiple battery chargers are sometimes employed in dc power systems to provide redundancy. Two (2) chargers of the same voltage rating can be connected in parallel, each of them capable of powering the connected dc load and charging the battery. When two (2) chargers operate in parallel, they normally will not share the load current equally. Since any two (2) chargers will usually have slightly different connection paths, one of the chargers in a system will typically have a slightly higher dc output voltage, and will therefore assume more of the burden of providing the necessary load current.

The ATevo forced load sharing feature currently supports a single "**Primary**" charger, and one (1) "**Secondary**" charger. The Primary charger communicates with the Secondary charger over a serial connection. Each ATevo requires a Serial Communications Adapter (A13) installed, and set for RS-485, to create the forced load sharing communication network.

The bagged accessory kit (ordering p/n EJ5306-##) consists of an interconnecting cable to provide such communications, and this *Installation & Operating Instructions* (**JA5054-50**).

SYSTEM REQUIREMENTS

- Both battery chargers must be *ATevo* Series. The ATevo forced load sharing feature will not operate with older style AT10.1 and AT30 Series battery chargers.
- Both ATevos must have the same voltage settings, have the same output current rating, and have the same version of Main Control PC Board (A1) firmware.
- Each ATevo requires a Serial Communications Adapter (A13) to be installed in either Port 2 or Port 3 of the Main Control PC Board (A1).

FORCED LOAD SHARING HARDWARE CONFIGURATION

If the ATevo is ordered with the forced load sharing feature, the hardware and software configuration will be completed at the factory. The forced load sharing Serial Communications Adapters (A13) and software will be verified during the charger production test. The signal interconnection cable will be supplied in a bagged kit, to be connected to the chargers in the field after installation.

If forced load sharing is added to an ATevo in the field, the following hardware and software configuration will be required.

1) Installing the Serial Communications Adapter (A13)

Refer to the Serial Communication Adapter section of the ATevo Communications Manual (p/n **JA0102-54**) for instructions on how to install the Serial Communications Adapter.

2) Configuring the Serial Communications Hardware

The jumpers on the Serial Comm Adapter (A13) must be configured to operate in 2-WIRE RS-485 mode.
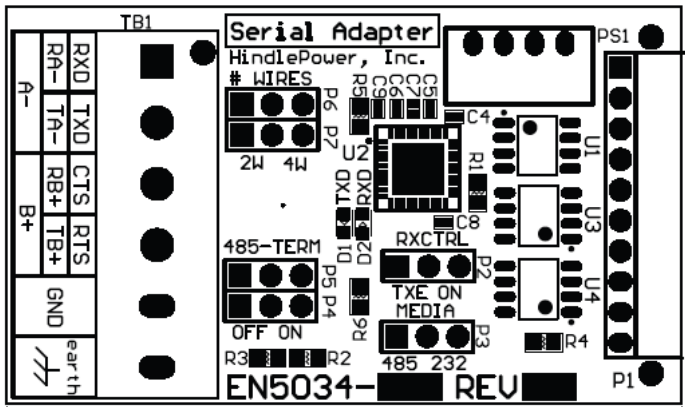
Jumper P2 (RXCNTRL) must be set to TXE - left two pins
Jumper P3 (MEDIA) must be set to 485 - left two pins
Jumpers P4 & P5 (485-TERM) must be set to OFF - left two pins
Jumpers P6 & P7 (# WIRES) must be set to 2W - left two pins

WIRING ATevo CHARGERS FOR FORCED LOAD SHARING

Both ATevos required to share load on the same dc bus must be connected to the same network. The network will consist of a twisted pair cable with ground. The Serial Communication Adapters (A13) on each ATevo must be parallel wired, point-to-point as follows:
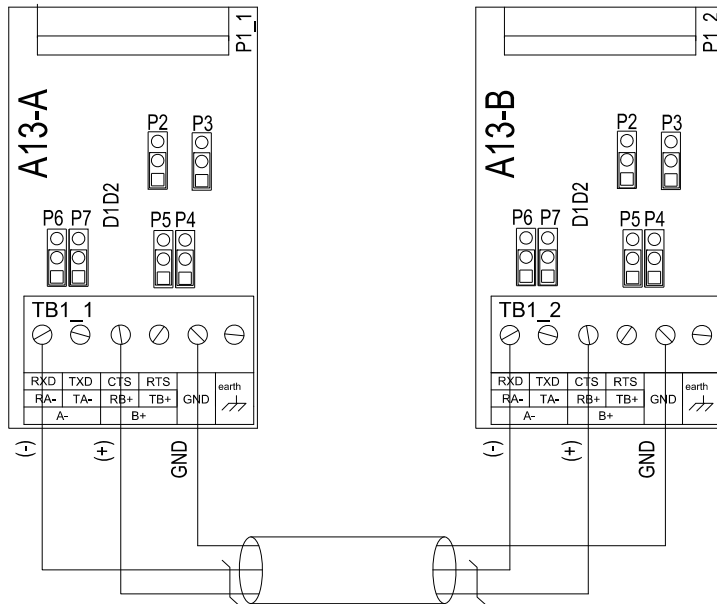
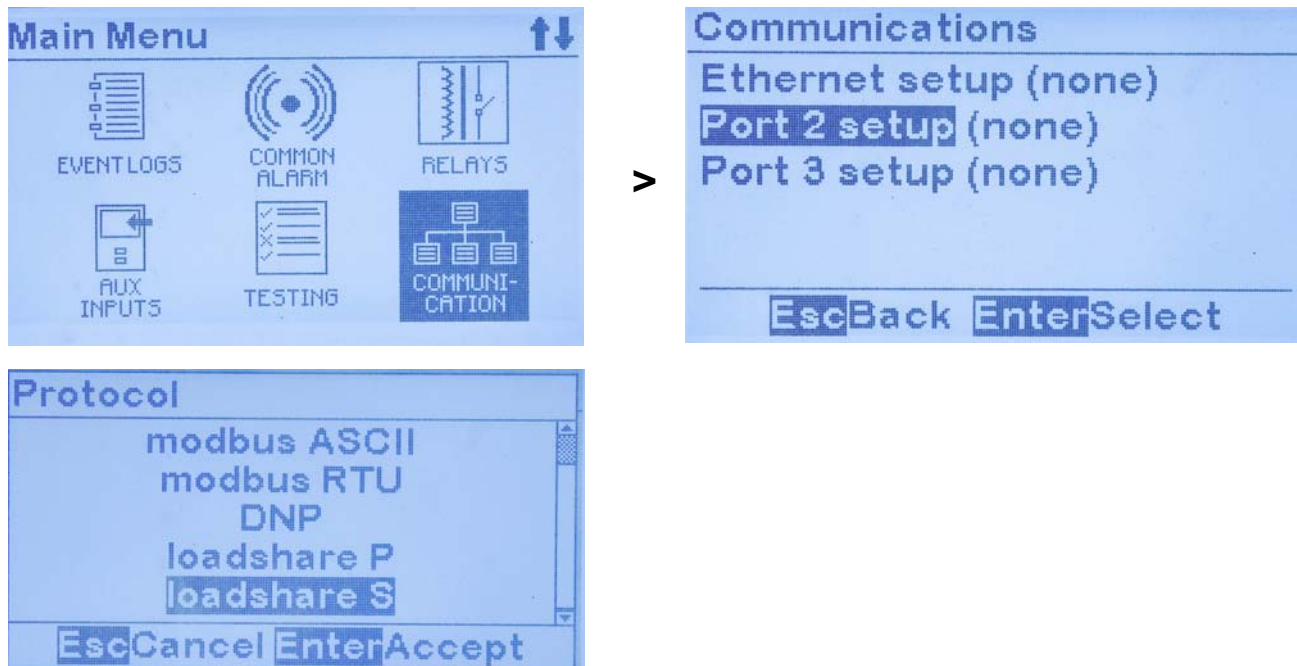| Wiring for Forced Load Sharing			
Cable	**Wire**	**ATevo-A**	**ATevo-B**
	(-)	RA(-)	RA(-)
1	(+)	RB(+)	RB(+)
	GND	GND	GND

1) Expandability

NOTICE   At the time of shipment of this document (p/n JA5054-50), ATevo Series battery chargers only support forced load sharing of two (2) units of similar configuration (primary and *one* secondary). See Figure on previous Page 2 of 8. Please ignore any references to three (3) or more ATevo charger sharing load that may appear in **Section 13** of the standard ATevo charger manual (p/n **JA0102-51**). Contact the your sales representative for future availability of sharing load with *more* than two (2) ATevo chargers.

2) Configuring ATevo for Forced Load Sharing

The two (2) ATevo units connected in forced load sharing must be configured as a Primary or Secondary charger, and must be assigned a charger ID. One (1) of the ATevos connected in forced load must be configured as the Primary charger, with the other configured as Secondary.

To configure an ATevo for Forced Load Sharing:
MENU > COMMUNICATION > Port 'X' setup

'X' is either '2' or '3' for Port 2 or Port 3. The Port configured for forced load share must be the port that the Serial Communications Adapter is plugged in to that is wired to the Forced Load Sharing network.


Select either "loadshare P" for the Primary ATevo, or "loadshare S" for a Secondary ATevo. Only one (1) ATevo can be the Primary. The other ATevo on the forced load sharing network must be set to Secondary.

Press the EDIT/ENTER button to accept the new selection. The Charger ID may now be changed (see the following passage on page 4 of 8). Press the ESC button to return to the previous screen. If a port setting was changed, the ATevo will prompt to RESET. Select YES to RESET the ATevo. The new port settings will not become active until after the ATevo is RESET.

ATevo Forced Load Sharing

To configure the ATevo Load Share Charger ID:
MENU > COMMUNICATION > Port 'X' setup > Charger ID
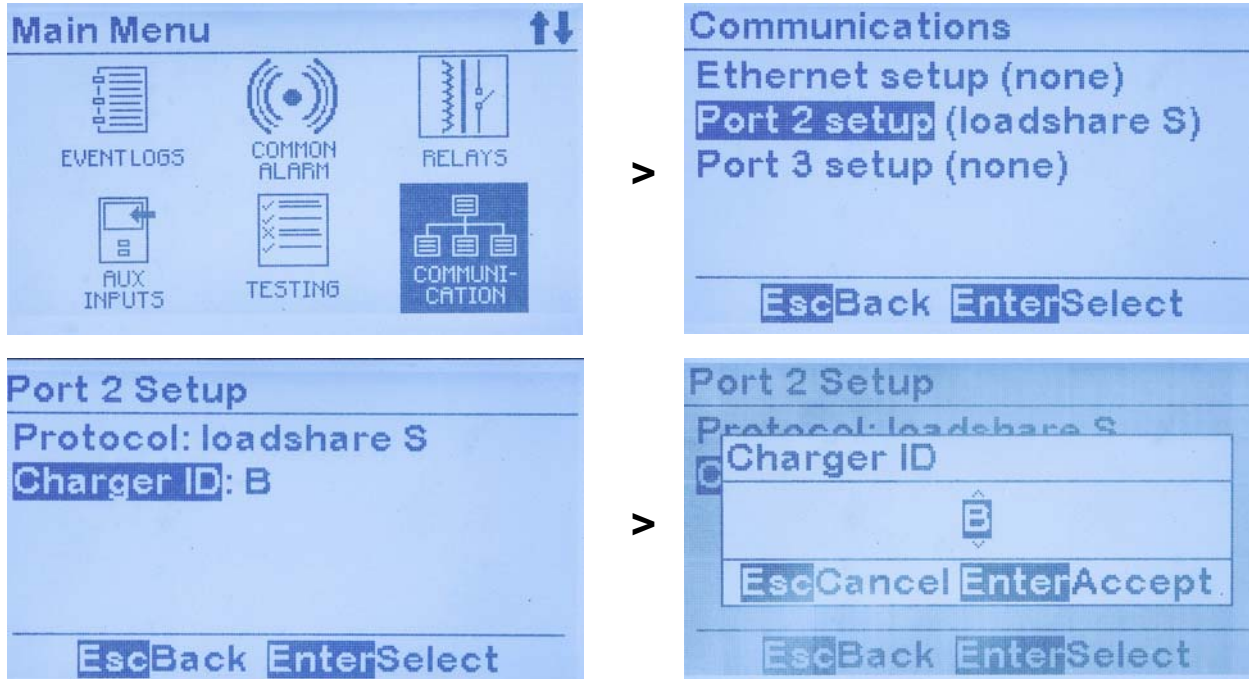
     Use the UP and DOWN arrows to select the Charger ID (A, B C, or D). Each ATevo on the forced load sharing network must have a unique Charger ID (typically the Primary ATevo's Charger ID is set to 'A').

     Press the EDIT/ENTER button to accept the new selection. Press the ESC button to return to the previous screen. If a port setting was changed, the ATevo will prompt to RESET. Select YES to RESET the ATevo. The new port settings will not become active until after the ATevo is RESET.
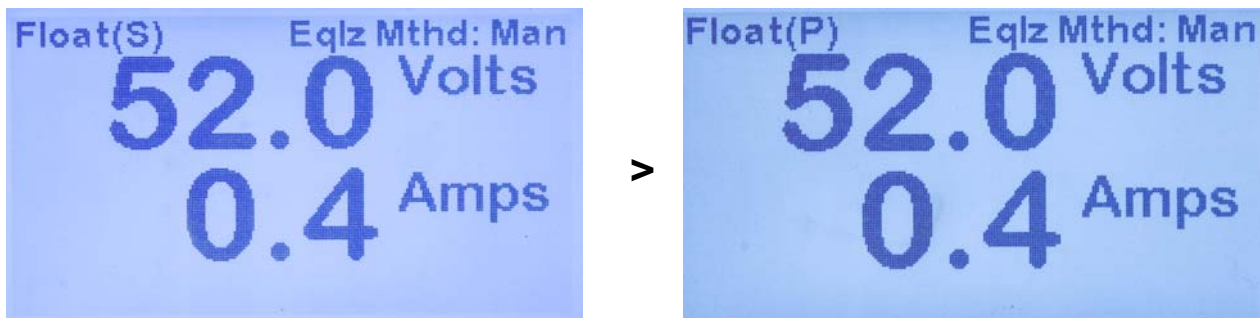
ATevo FORCED LOAD SHARING OPERATION

The ATevo configured as Primary runs a discovery poll each time it is reset or power-cycled. For discovery to work, the ATevo configured as Secondary will need to be powered *before* the Primary. During a discovery poll, the Primary ATevo sends out a sequence of queries directed at ATevos with Charger ID A, B, C, and D. If the Primary ATevo gets a response, it records the Charger ID of the ATevo in its database, and immediately attempts to start sharing load with that ATevo. Once a Primary ATevo discovers a Secondary ATevo, it expects that Secondary ATevo to be present the next time it is reset or power-cycled. As such, the Primary ATevo will continuously poll any Secondary ATevo it previously discovered, whether it is present or not. It will no longer matter which ATevo starts up first, following a power cycle or reset.

A discovery poll can also be initiated by a user on demand via the system settings menu on the Primary ATevo. To initiate a discovery poll on the Primary ATevo without reset or a power cycle:

MENU > SYSTEM SETTINGS > discover new hardware
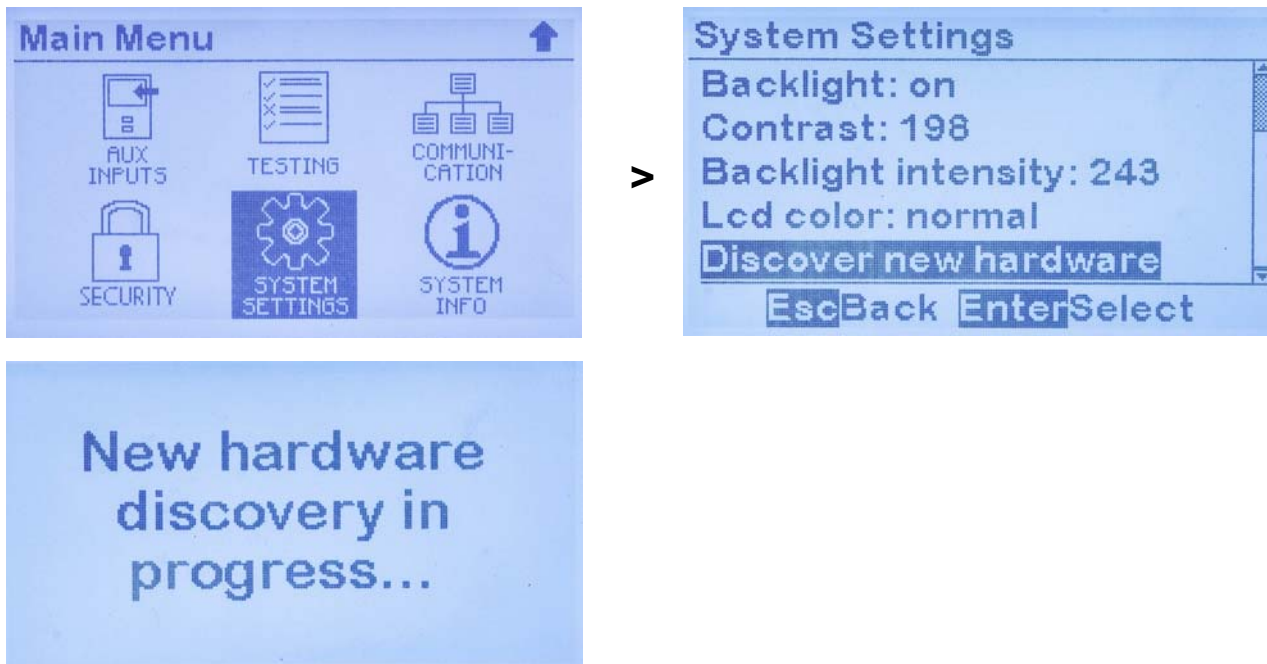
An ATevo battery charger will indicate that it is actively sharing load on the main display. Next to the charger mode, Primary ATevos will show "(P)", and Secondary ATevos will show "(S)". This is referred to as the "loadshare indicator". The Secondary ATevo always knows the mode of the Primary controlling it, and will display the same mode. This can be Float, Equalize, or Battery Open Test.

ATevo Forced Load Sharing

1) Requirements to maintain Forced Load Share

There are several events that cause ATevos to break Forced Load Sharing, and resume independent output control.
- communication failure between ATevos
- an ATevo is shut down
- an ATevo reports that it is not ready - reasons for not being ready include:
  - AC input failure or low AC line
 - open DC breaker (CB2)
  - HLD or HVDC present

When the issue is corrected, ATevos resume sharing load and will again display the loadshare indicator next to mode.

2) Virtual Independent Mode

The purpose of Virtual Independent Mode is to detect when an *external* dc branch breaker is opened, with the ATevos in Force Load Sharing. ATevos not connected to the same dc bus cannot share load. There are two (2) conditions that will cause Forced Load Sharing ATevos to go into Virtual Independent mode.

1) when total load shared between ATevos is less than 1.0 Amperes
2) when output voltage of any Secondary ATevo, that is actively sharing load, drops 1.5% under the output voltage of the Primary ATevo

If either one of the above conditions persists for more than 25 seconds, the chargers go into Virtual Independent Mode. This condition is cleared when the Primary ATevo detects the total current supplied by all chargers is greater than 1.0 Ampere, and the Primary ATevo itself is supplying at least 0.4 Amperes.
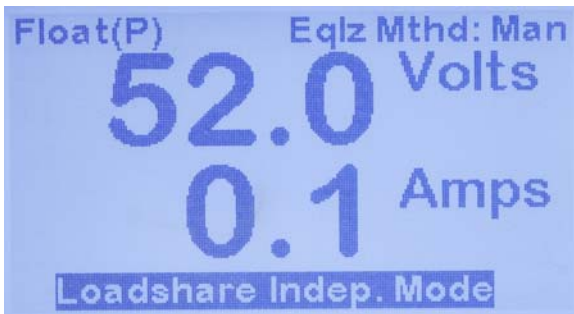
While in Virtual Independent mode, the ATevo will display the loadshare indicator and "Loadshare Indep. Mode" on the last line of the display.

3) Alarms Related to Forced Load Sharing

There are three (3) alarms related to ATevo Forced Load Sharing.
- Loadshare Not Ready
- Loadshare Comm Failure
- Loadshare Indep Mode

1) Loadshare Not Ready

This alarm is displayed on an ATevo that is not ready to share load for reasons including no AC power, low AC power, HVDC shutdown, HLD shutdown, or open DC breaker (CB2). The "Loadshare Not Ready" alarm is logged and can be configured to trigger the common alarm.

2) Loadshare Comm Failure

This alarm is displayed when an ATevo configured for Forced Load Sharing is not receiving any load sharing messages. The "Loadshare Comm Failure" alarm is logged and can be configured to trigger the common alarm.

3) Loadshare Indep Mode

This alarm indicates virtual independence between FLS ATevos. It is presently only reported on the Primary ATevo. The "Loadshare Indep. Mode" status is logged and can be configured to trigger the common alarm.

TEMPERATURE COMPENSATION WITH FORCED LOAD SHARING

The recommended practice for an ATevo Forced Load Sharing application, which uses temperature compensation, is for each ATevo to have a battery temp probe (A10) and have temperature compensation initiated.

BATTERY OPEN ALARM WITH FORCED LOAD SHARING

The recommended practice for an ATevo Forced Load Sharing application, which employs periodic Open Battery Testing, is to only enable the test on the Primary ATevo. As long as load sharing is active, the Primary ATevo will dictate the battery open test voltage setting to all Secondary chargers when a scheduled test runs. It is always possible to manually initiate a Battery Test from a Primary or Secondary ATevo, when load sharing is active.

TIMED EQUALIZE WITH FORCED LOAD SHARING

If a timed equalize is in progress, all ATevos sharing load will display equalize time remaining, alternating with the volt/ammeter display. If the sharing ATevos go independent while timed equalize is active, they will continue timed equalize. If a Primary ATevo goes offline, the Secondary ATevo will continue in timed equalize mode until the Primary ATevo come back online. The Primary ATevo and all Secondary ATevos will switch back to float mode after the Primary ATevo resets.
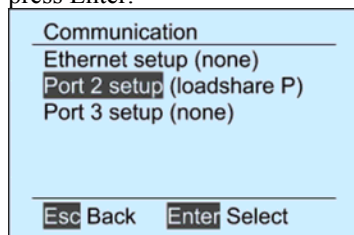
AUTO-EQUALIZE WITH FORCED LOAD SHARING

If desired, Auto-Equalize mode only needs to be configured on the Primary ATevo. Secondary ATevos can also enable Auto-Equalize mode, but it will only matter if the Primary ATevo is offline.

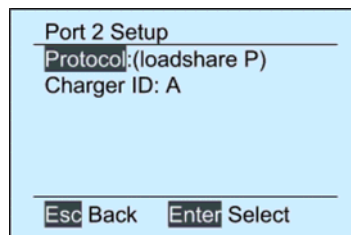## DISABLING FORCED LOAD SHARING

It is not necessary to physically remove or disconnect communication hardware (A13 pcb & cable) between ATevos to disable Forced Load Sharing. It is probably desirable to leave it in place, for when it may be enabled.

Disable load sharing between ATevos by setting the serial communication protocol for load share Port to "unconfigured". If Forced Load Sharing is being disabled temporarily, it is only necessary to disable it on the primary charger to avoid alarms. Only one of the ATevos will be set to Primary (loadshare P) which can be determined through the steps below. If Forced Load Sharing will be disabled permanently, it is recommended that it also be disabled on secondary chargers (loadshare S). The hardware should also be removed.
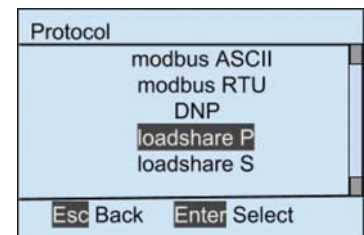
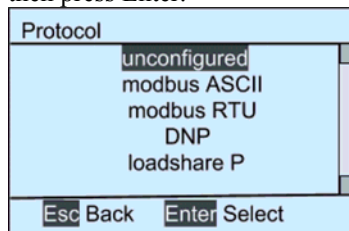**1)** Navigate to menu/communication, select port used for loadshare, and press Enter.

```
Communication
Ethernet setup (none)
Port 2 setup (loadshare P)
Port 3 setup (none)

Esc Back    Enter Select
```

2) Select "Protocol", then press Enter.

```
Port 2 Setup
Protocol:(loadshare P)
Charger ID: A

Esc Back    Enter Select
```

3) The display should look as follows.

```
Protocol
        modbus ASCII
        modbus RTU
            DNP
        loadshare P
        loadshare S

Esc Back    Enter Select
```

4) Scroll up to select "unconfigured" then press Enter.

```
Protocol
    unconfigured
    modbus ASCII
    modbus RTU
        DNP
    loadshare P

Esc Back    Enter Select
```

5) The new setting will now be "unconfigured".

```
Port 2 Setup
Protocol: unconfigured

Esc Back    Enter Select
```
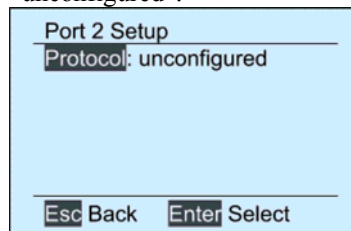
6) Press Esc twice and the following should be displayed.

```
Reset Charger
The charger must be reset
to apply new settings.
Would you like to reset
now?        no
            yes

Esc Back    Enter Select
```
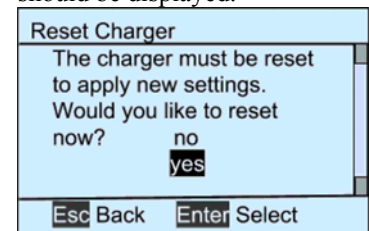
7) Press "Enter" to accept changes and restart ATevo without loadshare.

UPDATING FIRMWARE ON ATevo WITH FORCED LOAD SHARING

The recommended sequence to update firmware on ATevos sharing load is to update Secondary chargers *first*, and Primary chargers *last*. If communications issue occur after the upgrade, reset the Primary ATevo, or rerun discover mode on the Primary ATevo.

TROUBLE-SHOOTING ATevo DURING FORCED LOAD SHARING

- Make sure that at least one ATevo is configured as Primary on Port 2 or 3, and a Serial Communication Adapter (A13) is plugged into that port.
- Make sure that at least one ATevo is configured as Secondary on Port 2 or 3, and a Serial Communication Adapter (A13) is plugged into that port.
- Make sure that each Serial Communication Adapter board (A13x) used for Forced Load Sharing is configured for RS-485, and is wired correctly.
- Verify that the chargers are communicating. The Serial Communication Adapters (A13) have a yellow and green LED that light briefly when the ATevo is sending or receiving data respectively. These LEDs can be used to identify the source of problems.
- Verify the voltage calibration of all ATevos connected in Forced Load Sharing.

ORDERING PARTS

You may order longer interconnection cables, replacement circuit boards, or full field installation kits through your sales representative. Please use the part numbers shown in the table below.

ORDERING PART No.	DESCRIPTION
EH5052-01	15ft (4.6m) interconnection cable assembly field kit
EH5052-02	25ft (7.6m) interconnection cable assembly field kit
EH5052-03	50ft (15.2m) interconnection cable assembly field kit
EN5034-00.	spare ATevo Serial Communications Adapter (A13)
EN5031-00.	spare ATevo Main Control PC Board (A1)
EJ5306-21 (field kit)	two (2) ATevo Serial Communications Adapters (A13) with one (1) 15ft (4.6m) interconnection cable assembly
EJ5306-22 (field kit)	two (2) ATevo Serial Communications Adapters (A13) with one (1) 25ft (7.6m) interconnection cable assembly
EJ5306-23 (field kit)	two (2) ATevo Serial Communications Adapters (A13) with one (1) 50ft (15.2m) interconnection cable assembly

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ON-LINE AVAILABILITY

An electronic copy of these instructions is available at **http://www.ATSeries.net/PDFs/JA5054-50.pdf**, along with standard drawings for the ATevo Series battery chargers. Saved online in Adobe Acrobat Portable Document Format (PDF), they are readily available for downloading and printing.