TECHNICAL NOTE TN-1100-AN

**APCO P25 Battery Charger
Firmware Upgrade**

20 March 2006

Applicability

This Technical Notes applies to the TPA-CH-001 single way charger.

1. Introduction

The information in this technical note is to provide options to CSO's on how to upgrade the firmware in the aforementioned APCO battery chargers.

At time of writing the current firmware version for APCO battery chargers is v1.05. It is hoped that there will not be many additional firmware releases for this product. However the firmware in the charger can be field upgraded and this technical note details the various options to perform such an upgrade.

2. ST7 STICK Programmer

What's in the Kit?

The ST7 STICK programming is the **low cost** solution to upgrade firmware in the APCO battery charger.

The ST7 STICK programming package includes the items pictured below:
- ST7 STICK interface board
- AC/DC power supply – rated output 12Vdc at 200mA
- PC Parallel port extension cable
- 10-pin HE10-type ribbon cable
- CD-ROM containing ST7 Programming Software

ST7 STICK Configuration and connection to PC

The configuration of the ST7 STICK interface board and connection to a PC is straightforward.

- Jumper **W1** on the ST7 STICK interface board must be set to **5V** as pictured below.
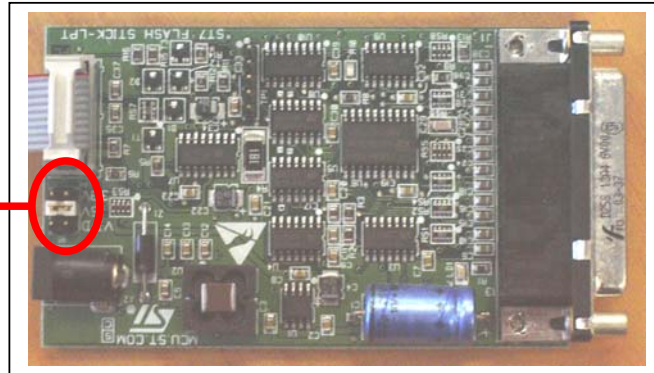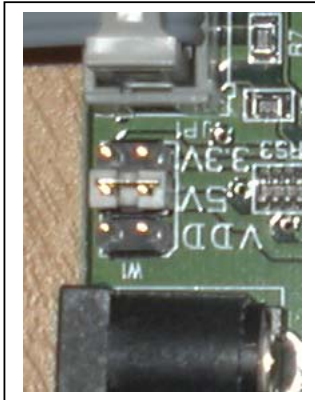
- Plug one end of the parallel port extension cable into the PC parallel port. **Note: The ST7 programmer will still function correctly even if one or more Tait hasp plugs are already connected to the PC's parallel port.**
- Plug the other end of the parallel port extension cable into the DB25 connector on the ST7 STICK interface board.
- Connect the 10-pin HE10-type ribbon cable to the ICC connector (**JP1**) on the ST7 STICK interface board.
- Connect the DC output of the AC/DC adaptor to the DC jack on the ST7 STICK interface board, and apply AC to the AC/DC adaptor.
- The ST7 STICK programmer is ready for use.

Installation and configuration of ST7 STICK Programming Software

- Insert the "Microcontroller Development Tools" CD in the CD-ROM drive.
- When the CD autoruns, select 'ST7' and choose to install the 'ST 7 Visual Desktop and ST7 Visual Programmer'.
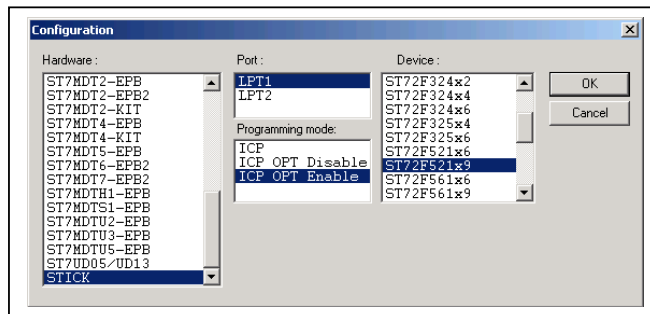

- Follow the on-screen prompts to install the software.
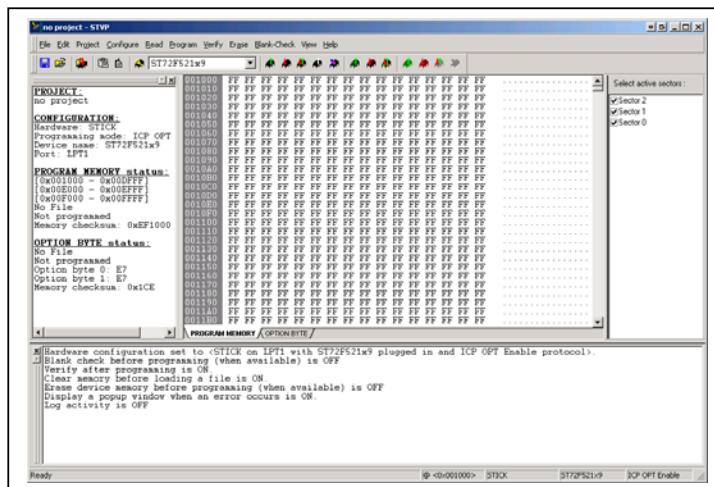- Exit the installation application.

- Select 'Start' / 'Programs' / 'ST 7 Toolset' / 'Development Tools' / 'ST7 Visual Programmer'.
- A 'Configuration' window will be presented.
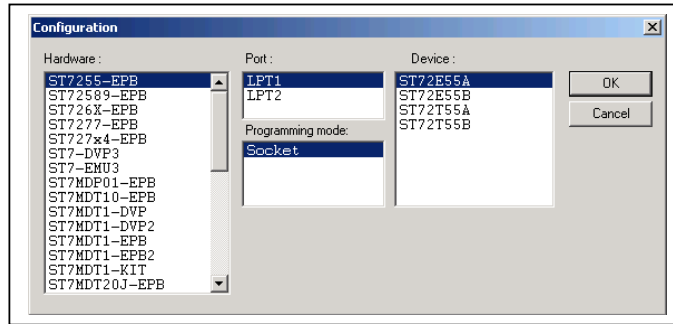
- Select the following configuration:
  - o **Hardware: STICK**
  - o **Port: LPT1**
  - o **Programming Mode: ICP OPT Enable**
  - o **Device: ST72F521x9**

- Click 'Ok'
- You will then be presented with the main Visual Programmer window.

- Installation and configuration is now complete.

Checking existing Battery Charger firmware version

The firmware version of the battery charger can be easily checked.

- Remove the DC supply from the charger.
- Using a screwdriver or other metal object short the middle two contacts in the battery 'bucket' as indicated below.
- Whilst shorting these two contacts re-apply the DC supply.

- The charger LED's will illuminate a number of times the firmware version can be read as:

  o   Major version number = number of Red LED flashes
  o   Minor version number = number of Green LED flashes

  Eg. Version 1.02 will flash Red LED once, followed by the green LED twice.

Connecting ST7 Programming lead to Battery Charger

The ST7 programming lead can be connected to the APCO battery charger without needing to completely disassemble the battery charger. The tools needed to gain access to the programming port are:
- Torx 10 screwdriver
- Needle-nose pliers

Note: All standard static safe precautions should be taken when handling the battery charger.
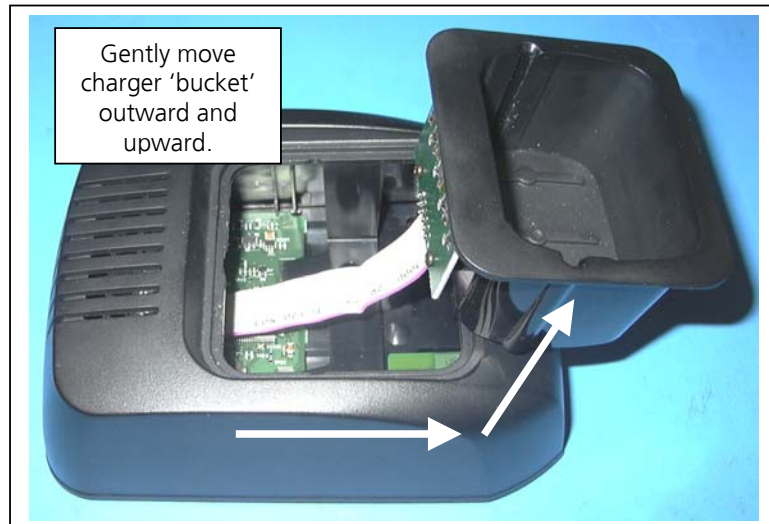
- Disconnect battery charger from DC supply.

- Turn battery charger up side down.


Remove these two screws

- Using a Torx 10 screwdriver remove the two screws indicated above.

- Turn battery charger over.

- Gently pull the charger 'bucket' forward and upward as demonstrated below. This exposes the charger PCB below.

Gently move charger 'bucket' outward and upward.

- Check the charger is capable of having its firmware upgraded.

- Charger PCB's of IPN **220-01724-03 or later** (date code on the charger label of **D05 or later**) are able to have their firmware upgraded. Earlier versions of the charger PCB cannot have the firmware upgraded.

- The programming port is a bank of 5 x 2 header pins, labelled as **J1**. The header pins are indicated below.

Programming port header pins
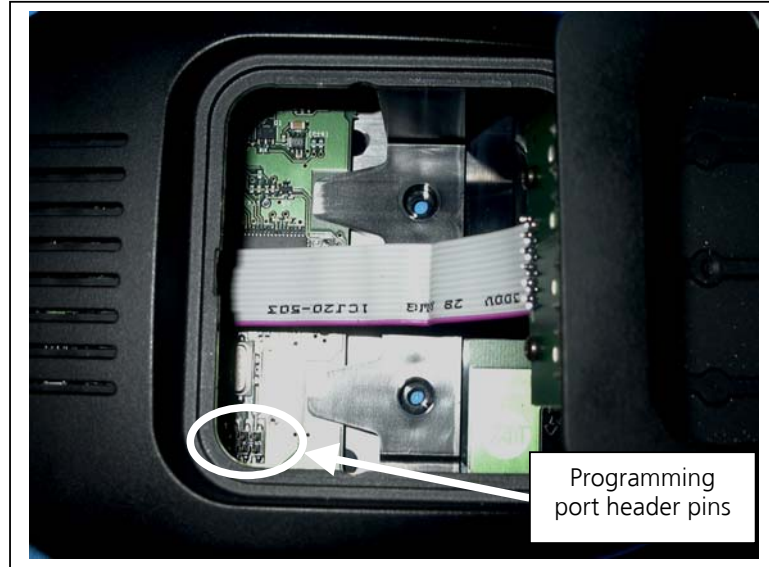
- Using a pair of needle nose pliers plug the ST7 STICK programming lead onto the header pins.
  Note: Make sure the orientation of the ST7 STICK programming lead is correct. The red stripe down the side of the cable indicates Pin 1. Pin 1 of J1 is marked on the charger PCB.


Note cable orientation. Pin 1 with red stripe to Pin 1 on PCB.
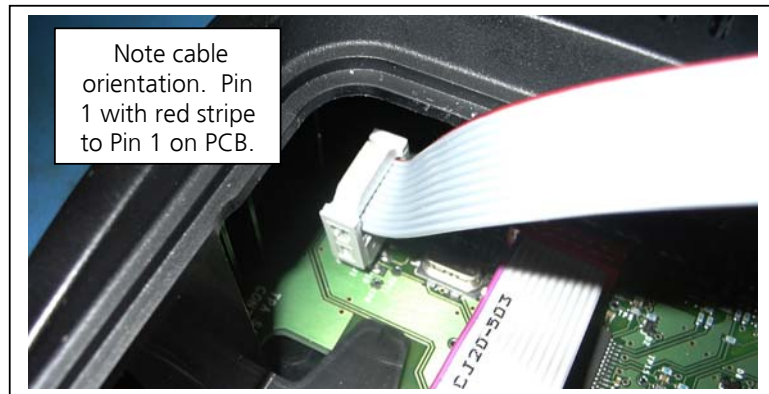
- Re-apply DC to the battery charger.

- Setup is now complete; the charger is ready for programming.

Upgrading the Battery Charger firmware

Once it has been determined that the battery charger firmware needs to be upgraded, follow the steps below:

- In the S7 Visual Programming Application select 'File…' / 'Open' from the menu.
- Select the firmware file you wish to load into the battery charger.
- Click 'Open'.
- In the status window at the bottom of the application you should see an indication that the file was successfully loaded.
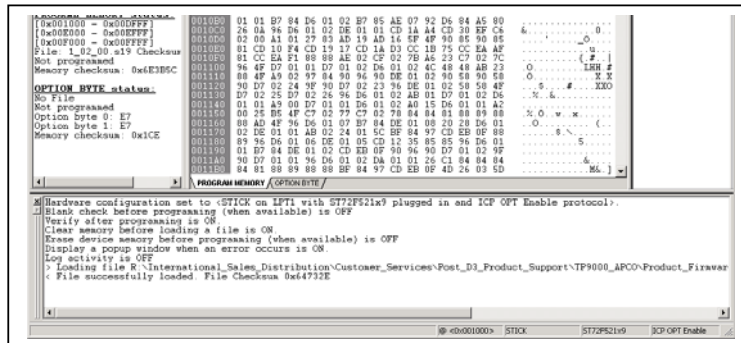

- In the ST7 Programming Application there are two tab boxes. By default the 'Program Memory' tab is selected. Click on the 'Option Byte' tab.
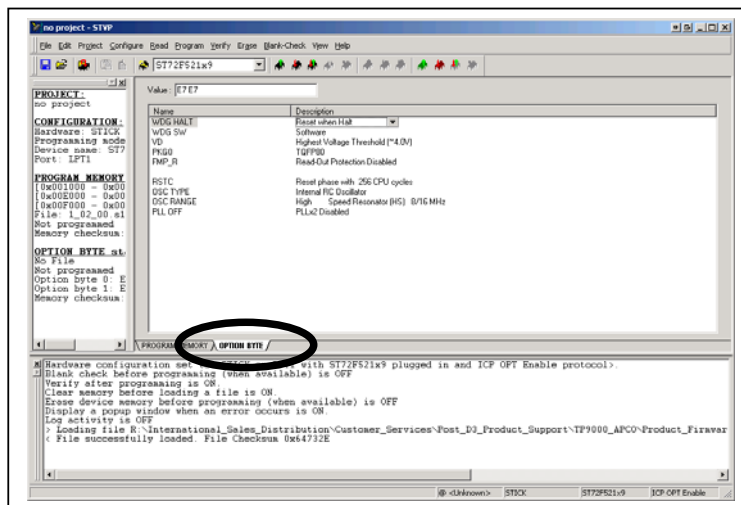

- Set the fields in the Option Byte field as follows:
  - WDG HALT (Watchdog and Halt): No reset when halt
  - WDG SW: Hardware
  - VD (Voltage Detect): Highest Voltage Threshold (~4.0V)
  - PKG0 (Package): TQFP64
  - FMP_R: **Read-Out Protection Disabled**
  - RSTC (Reset Cycle): Reset phase with 4096 CPU cycles
  - OSC TYPE: Resonator Oscillator
  - OSC RANGE: High Speed Resonator (HS) 8/16 MHz
  - PLL OFF: PLLx2 Disabled

The Read-Out Protection needs to be set to Disabled to set a flag in the Microprocessor to allow the firmware to be replaced with a new version. Without doing this, when trying to write the firmware an error message will result.

- Select 'Program' / 'Current Tab' from the menu.
- This will program just the Option Byte parameters to the microprocessor. You should see a message indicating the OPTION BYTE has been successfully programmed and verified. You should also see that the contents of the device have been erased as the read-out protection has been changed.
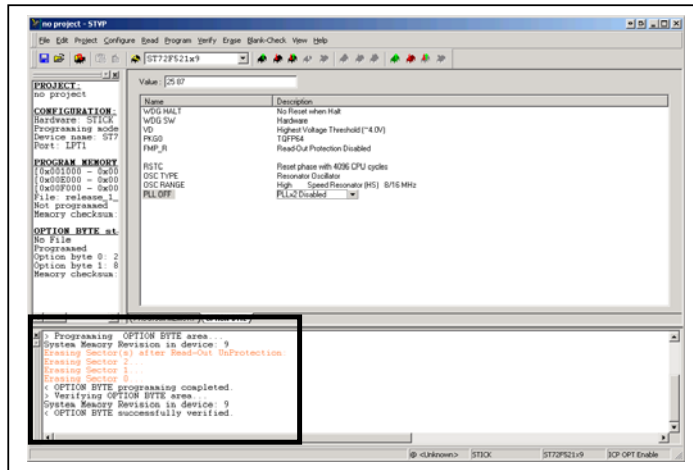
- Now change the FMP_R field to 'Read-Out Protection Enabled'
- Next click on the 'PROGRAM MEMORY' tab.
- Select 'Program' / 'All Tabs' from the menu.
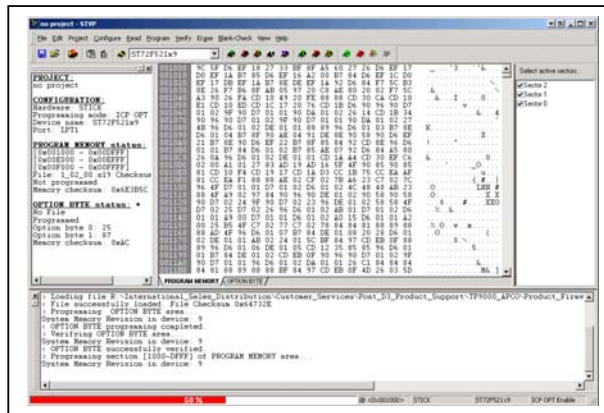
The new firmware will be downloaded to the charger, when the Option Byte is programmed a warning message will appear.
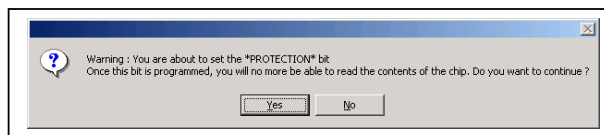
- Select 'Yes', and the Option Byte settings will be programmed to the charger.

- Select 'Read' / 'All Tabs' from the menu.

An error message should appear.

It is important to ensure the read protection has been set correctly because there is considerable intellectual property within the algorithms contained in the charger firmware.

- Click 'Ok'.

The upgrade of the charger firmware is complete.

Charger Reassembly

Follow; in the reverse order the instructions for **Connecting ST7 Programming lead to Battery Charger**.

Verify Charger Operation

Verify the battery charger operation as follows:

- Remove the DC supply from the charger.
- Using a screwdriver or other metal object short the middle two contacts in the battery 'bucket' as indicated below.
- Whilst shorting these two contacts re-apply the DC supply.

- The charger LED's will illuminate a number of times the firmware version can be read as:

  o Major version number = number of Red LED flashes
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  Eg. Version 1.02 will flash Red LED once, followed by the green LED twice.

Verify the charger charges batteries by inserting an APCO portable battery into the charger and check the Charging LED lights correctly.

Compliance Issues

None

CSO Instruction

Due to the Intellectual Property contained in the charger firmware, the firmware file should not be given to any dealer. All charger upgrades should be performed by a Tait CSO.

3.   Issuing Authority

**Name and Position
of Issuing Officer**
Tim Lummis
Technical Support Engineer

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