Fury Firmware Upgrade Instructions – rev. 1.1 (Fury2 software version 1.02 and later)

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The following is a short tutorial on how to upgrade the Fury GPSDO firmware. Please follow the instructions in-order to prevent corrupting the Fury Flash, which may require reflashing at the factory.

With some practice, the entire Flash upgrade can be done in less than one minute, even though the following seems like a fairly long list of instructions.

I. ISP Flash Loader Utility installation

Please download and install on your RS-232 enabled PC the Philips LPC2000 firmware upgrade utility from the following website:

```
http://www.nxp.com/products/microcontrollers/support/software_download/
lpc2000/index.html
```

Please ensure that you have at least version 2.2.3 of the LPC2100 flash utility installed. Earlier versions may not recognize the LPC2136 processor used on Fury.

II. Recording Factory Callibration data

It is not necessary to do the following, but it is recommended that the factory calibration data is written-down on paper in case the flash update fails for some reason. Follow the steps in this section to print out important calibration data:

A) The unit can be controlled via the Serial port at 115200 baud, 8N1 (defaults), but this only works if the LCD display shows "SCPI MODE". In Fury Desktop units the system is set to SCPI mode by default.

For Fury units with LCD connected, the RS-232 receiver is disabled outside of the "SCPI" display page. Swap through the LCD menu pages with a momentary-on type button connected to JP1 pins 5 and 6 until the LCD display shows "SCPI MODE". Make sure Hyperterm is set to the same Baud rate as shown in the LCD display (typically 115200 Baud)

B) B) At the prompt, type in: serv? and press [enter]. The following (similar, every unit's data etc will be different) will appear:

```
scpi > serv?
COARSE DAC : 121
EFC SCALE : 3.00
EFC DAMPING: 500
OCXO SLOPE : NEGATIVE
TEMPERATURE COMPENSATION : 262.00
AGING COMPENSATION : -0.00554
PHASE CORRECTION : 25.000000
1PPS OFFSET : 0 ns
TRACE : 0
```

[PLEASE NOTE THAT THE ABOVE VALUES ARE REPRESENTATIVE, AND SHOULD NOT BE ENTERED INTO YOUR FURY UNIT!]

Note down the **Coarse DAC**, **EFC Scale, EFC damping**, **OCXO slope**, **Temperature compensation** (this value is quite important and varies from unit to unit!), **aging compensation**, and **Phase correction** parameters so these can be typed in later in case these original values are lost for some reason.

III. Preparing the Desktop Unit for software installation

In order to upgrade the Fury firmware, the desktop enclosure has to be opened.

First and most importantly, disconnect the Fury unit from AC mains power, or from any other power source you may have connected.

Carefully remove the four screws on the faceplate (side with BNC connectors only) of the Fury units as shown in the following picture. Please note not to tighten the screws too much when re-assembling the unit, the screws may very easily strip the aluminum enclosures' threads.

Remove the four screws indicated by the red arrows:

IV. Turning the unit into In Circuit Programming (ISP) mode

After removing the four screws as described in the previous section., carefully pull-out the faceplate to about 1 inch in length until the Red Jumper JP3 (marked by the red arrow in the picture below) is visible.

Using tweazers or very small plyers, move the jumper JP3 (next to RS232 connector) from position 1-2 to position 2-3. Be carefull not to touch the adjacent cables and connector pins with the tweazers or plyers.
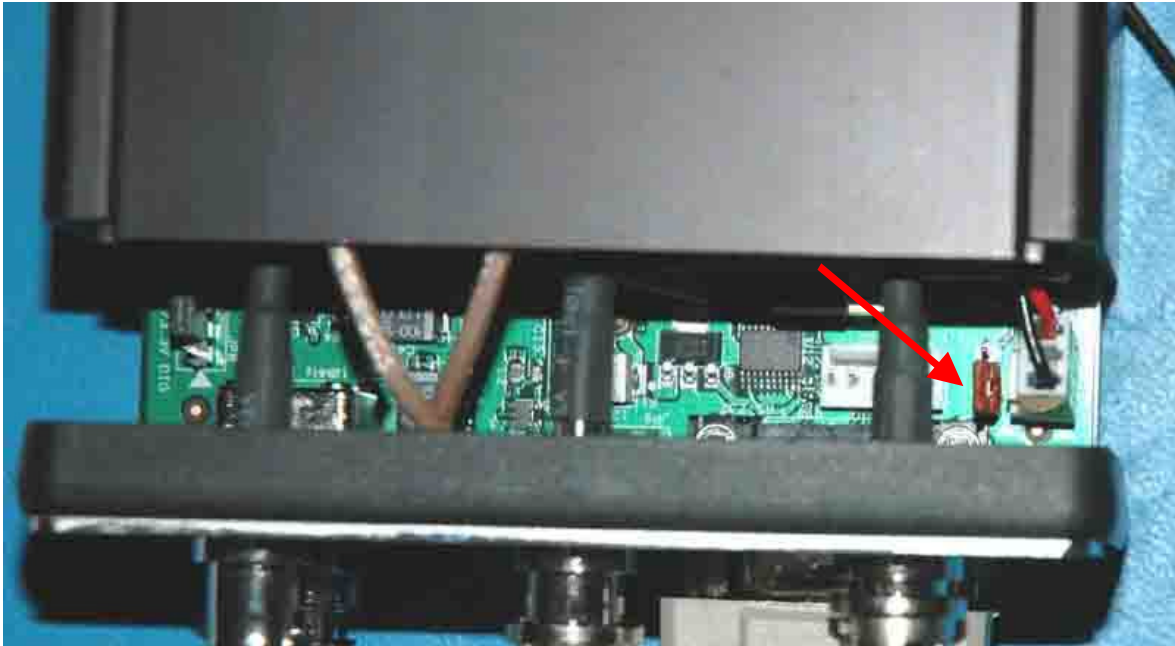
Push the PCB back into the enclosure making sure that the unit is fully closed. Re-apply power to the unit.

Now press the **RESET** button or **power cycle** the unit. If the LED's blink, the jumper JP3 has not been set correctly, and the unit is not in ISP mode.

The unit has now been set to ISP mode, and is awaiting the firmware download.

V. Downloading the firmware

A) Close Hyperterm, and open the LPC2000 utility. Set the COM port in the LPC2000 application as needed on your PC.
B) Press the "READ DEVICE ID" button, this should then show "LPC2136" in the DEVICE window if the unit is communicating correctly to the application.

Make sure NOT(!!) to press the "erase" button under any circumstances, this may erase factory calibration data, and the unit will not operate and will have to be

**returned to the factory. Pressing the "erase" button on the ISP utility will thus void the warranty.**
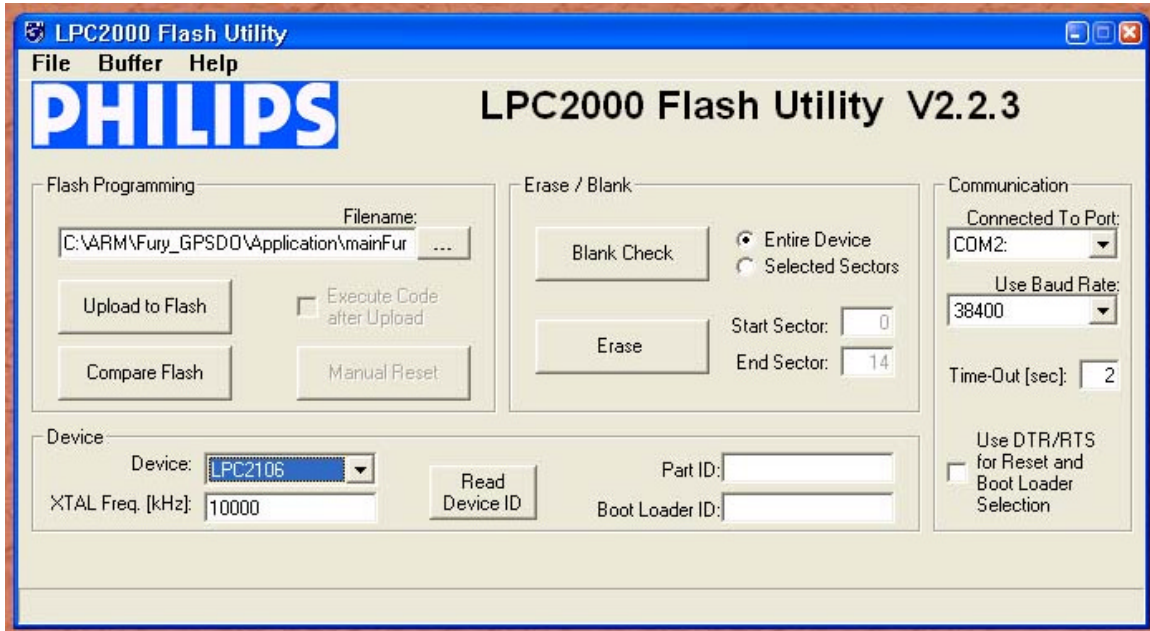
Please note that the "Use Baud Rate" setting needs to be set to 38400 Baud or less, it will not work faster than 38400 Baud.

Please note that the DEVICE should show "LPC2136"

Also, please point the "Filename" to the directory where you have stored the **firmware hex file** that is to be downloaded.

B) Start the download by pressing "**Upload to Flash**" button. The following window should appear if the correct COM port has been chosen etc:
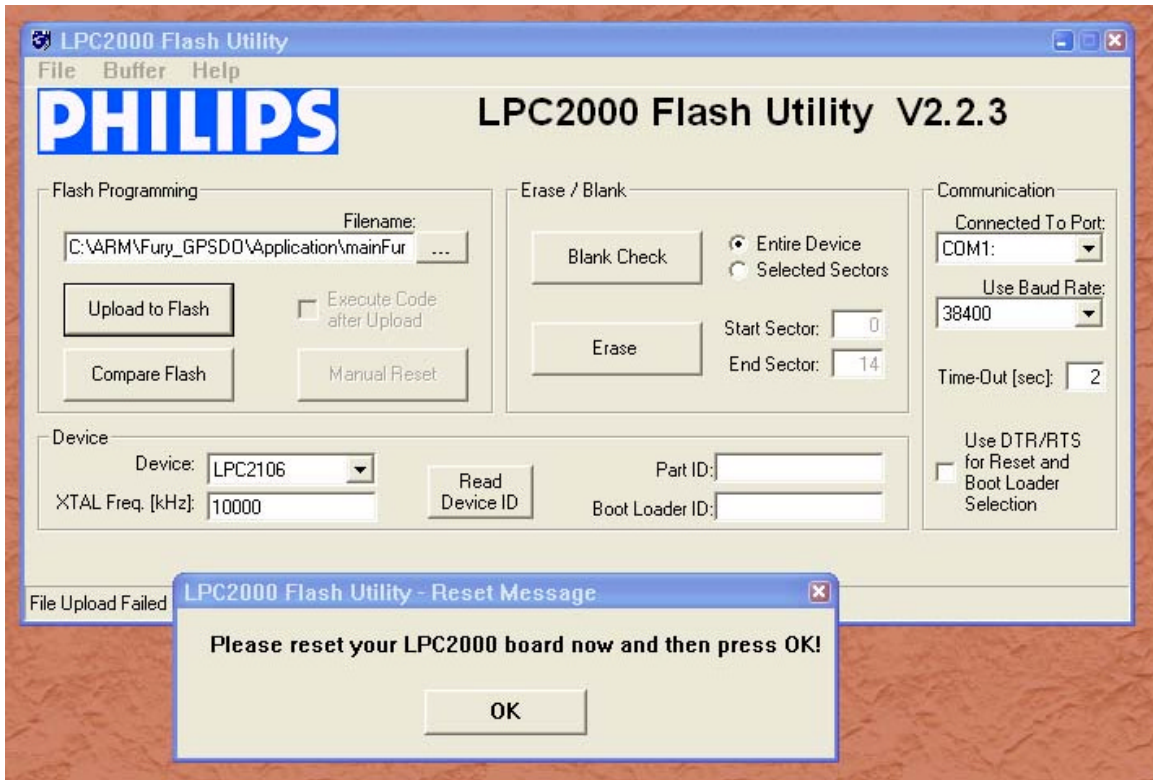
Press the "OK" button, and the download should start. Sometimes the utility get's confused and this process (from item **V. B**) has to be tried several times.

Usually, it is not necessary to press "reset" as the utility is asking. Just press "OK" on the utility windows' button.

If you reset the unit, then please make sure that jumper JP3 is set to pins 2-3.

DO NOT PRESS THE "ERASE" BUTTON AT ANY TIME! THIS WILL RENDER THE PCB USELESS AND CAN ONLY BE RECOVERED AT THE FACTORY!

VI. Updating Parameters

    A) After the download has finished, remove power from the unit.
    B) Carefully pull out the PCB as described in section IV.
    C) Re-adjust jumper JP3 to pins 1-2. This will allow normal operation after a power-cycle/reset.

Please note that jumper JP3 has to be in the 1-2 position (moved in the direction of the adjacent faceplate) in order for the unit to operate normally!

    D) B) Close the LPC2000 utility, and restart hyperterm

E) Carefully push the PCB back into the enclosure, and add the screws to the enclosure, being careful not to strip the enclosures threads.

F) C) Press the RESET button, or power-cycle the unit.

The LED's should blink, and/or the ALARM LED should light up.

For units with LCD display, verify that the LCD is in the "SCPI MODE" page, and that the Baud rate shown in the LCD display matches the Hyperterm setting.

During power on, the unit sends an ID string to Hyperterm. The firmware version can also be quereyed by sending the ***IDN?** command. Verify that the firmware version is version 1.02 or above.

VII. Entering the calibration parameters in case the Flash was corrupted for some reason.

Type the command serv? and compare the new settings to the old firmware's settings noted down on paper previously.

Re-enter any settings that do not match the previous settings of the older firmware.

Type "**help?**" to get instructions of how to enter the data into the "SERV" structure.

Verify that all settings have been correctly entered by typing "serv?" at the end of the data entry session.

This concludes the firmware update procedure.
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VIII. Short command reference

There are a number of commands that can be used, as listed below. Most of these are identical to Symmetricom 58503 commands; Jackson Labs added the following:

SYNC:FEE?
This query returns the Frequency Error Estimate

MEAS?
shows OCXO voltage, current etc.

and others.

Type "help?" to get the complete list (please note that additional commands are added as the firmware matures):

help?
SERVo:COARSeDac <int> [0,225]
SERVo:EFCScale   <float>[0.0 , 500.0]
SERVo:EFCDamping <float>[0.0 , 4000.0]
SERVo:SLOPe   <NEG | POS >
 SERVo:TEMPCOmpensation <float> [-1000.0, 1000.0]
 SERVo:PHASECOrrection   <float> [-100.0, 100.0]
 SERVo:1PPSoffset   <int> ns
 SERVo:QUIet   <ON | OFF>
(all Fury specific to tune the PID. In production, they should be set in
Factory)

SYNChronisation:HOLDover:DURation?
(From Symmetricom 58503 manual)
This query returns the duration of the present or most recent period of
operation in the holdover and holdover processes. This is the length of time
the reference oscillator was not locked to GPS. The time units are seconds.
Response The first number in the response is the holdover duration. The
duration units are seconds, and the resolution is 1 second. If the Receiver
is in holdover, the response quantifies the current holdover duration. If
the Receiver is not in holdover, the response quantifies the previous
holdover. The second number in the response identifies the holdover state. A
value of 0 indicates the Receiver is not in holdover; a value of 1 indicates
the Receiver is in holdover. :SYNChronization:HOLDover:DURation? RESPONSE
FORMAT Returns the duration of the present or most recent period of
operation in the holdover and holdover processes. ± d.dEe, 0 or 1

SYNChronisation:TINTerval
(similar to Symmetricom 58503)
This query returns the difference or timing shift between the Fury 1 PPS and
the GPS 1 PPS signals.
 Resolution is 1E-10 seconds.

SYNChronisation:IMMEdiate
(From Symmetricom 58503 manual)
:SYNChronization:IMMediate Initiates a near-instantaneous alignment of the
GPS 1 PPS and Receiver output 1 PPS if the command is issued during recovery
from holdover.

SYNChronisation: :FEEstimate?
This query returns the Frequency Error Estimate

DIAGnostic:ROCSillator:EFControl:RELative?

(From Symmetricom 58503 manual)
This query returns the Electronic Frequency Control (EFC) output value of
the internal reference oscillator. It returns a percentage value.
Response Range is -100% to +100%. :
Currently the Fury returns a number between 0 and 100% but I will change it
to be compatible to Symmetricom in next firware release

GPS:INITial:DATE   <yyyy:mm:dd>   Used to set the GPS receivers initial
date at start up
        :TIME   <hour:min:sec>   Used to set the GPS receivers initial
time at start up
        :POSition <N|S <deg,min,sec>, E|W <deg,min,sec>, <height in
meters> > Set initial position
(From Symmetricom 58503 manual)
This command sets an approximate position for faster initial GPS
acquisition. Following powerup, the Receiver refines its position from the
satellite data. This process occurs automatically. This command is most
effective when the retained position differs significantly from the Receiver
s true position.

GPS:REFerence:ADELay <float> <s | ns >
(From Symmetricom 58503 manual)
:GPS:REFerence:ADELay <seconds> Sets the GPS antenna delay value in seconds.
:GPS:REFerence:ADELay? Returns the GPS antenna delay value in seconds.

GPS:REFerence:TRAIM ON | OFF   Turms M12+ train on and off
GPS:REFerence:TRAIM:RSVIDs?
(specific Fury)
32 bit field to indicate which SVIDs were removed by TRAIM.
This comes from the message @@Hn of Motorola M12+

GPS:REFerence:PULse:SAWtooth?
(specific Fury)
negative sawtooth time error of next 1 PPS coming from the GPS recevier
(-128, +127 ns)
This comes from the message @@Hn of Motorola M12+

GPS:REFerence:PUlse:ACCuracy?
(specific Fury)
Time solution 1 sigma accuracy estimate
 This comes from the message @@Hn of Motorola M12+

GPS:REFerence:PULse?
(specific Fury)

Pulse status (0 or 1)
 This comes from the message @@Hn of Motorola M12+

GPS:SATellite:TRACking:EMANgle <int> [0,89]   ???????????
(From Symmetricom 58503 manual)
:GPS:SATellite:TRACking:EMANgle <degrees> Sets the GPS elevation mask angle value.
:GPS:SATellite:TRACking:EMANgle? Returns the GPS elevation mask angle value.

GPS:SATellite:TRACking::COUNT?
(From Symmetricom 58503 manual)
Returns a list of all satellites being tracked.

GPS:SATellite::VISible:PREDicted:COUNT?
(From Symmetricom 58503 manual)
Returns the number of satellites (PRN) that the almanac predicts should be visible, given date, time, and position.

GPS:POSition   <N|S <deg,min,sec>, E|W <deg,min,sec>, <height in meters> >
(From Symmetricom 58503 manual)
Specifies the position of the GPS antenna.

GPS:POSition   LAST
(From Symmetricom 58503 manual)
LAST denotes the last specified position. This parameter is provided to cancel surveying (automatic position computation) and restore the last position setting.

GPS:POSition:HOLD:LAST?
(From Symmetricom 58503 manual)
This query returns the last position-hold setting, which is restored when the :GPS:POSition LAST command is sent.

GPS:POSition:SURVey:STATe   ONCE
(From Symmetricom 58503 manual)
Set the GPS Receiver in Auto-Survey
GPS:POSition:SURVey:STATe?
(From Symmetricom 58503 manual)
 Return (0 or 1) to specify if the GPS Receiver is in Auto-Survey or not

MEASure:TEMPerature?
(specific Fury)
This query returns the temperature of the sensor located next to the OCXO
MEASure:VOLTage?

(specific Fury)
This query returns the voltage applied to the OCXO (around 10.5 V)

MEASure:CURRent
(specific Fury)
This query returns the current drawn by the OCXO. This current varies in order to keep a stable temperature inside the OCXO.

PTIMe:TZONe <hour,min> [-12,12],[0,59]
(From Symmetricom 58503 manual)
Sets the time zone local time offset to provide an offset from UTC to serve as the basis for all reported time.
:PTIMe:TZONe?
Returns the local time zone offset.

PTIMe:DATE?
(From Symmetricom 58503 manual)
This query returns the current calendar date. The local calendar date is always referenced to UTC time, offset by any local time zone value that has been provided by the user. The year, month, and day are returned.
 Response Three fields are separated by commas: <year>,<month>,<day>. " The <year> range is 1994 to 2077. " The <month> range is 1 to 12. " The <day> range is 1 to 31.

PTIMe:TIME?
(From Symmetricom 58503 manual)
This query returns the current 24-hour time. The local time is always referenced to UTC time, offset by any local time zone value that has been provided by the user. The hour, minute, and second is returned.
 Response Three fields are separated by commas: <hour>,<minute>,<second>. " The <hour> range is 0 to 23. " The <minute> range is 0 to 59. " The <second> range is 0 to 60. The value of 60 only occurs as the UTC leapsecond.

PTIMe:TIME:STRing?
(From Symmetricom 58503 manual)
This query returns the current 24-hour time suitable for display (for example, 14:22:34).

PTIMe:LEAPsecond:PENDing?
This query identifies if a leap second is pending. This query looks ahead to indicate a pending leap second.
Response A value of 0 indicates no leap second is pending. A value of 1 indicates a leap second is pending.
The leap second adjustment can be either the addition of a second or the subtraction of a second.

PTIMe:LEAPsecond:ACCumulated?
(From Symmetricom 58503 manual)
Returns the leap second difference accumulated between GPS time and UTC time
since the beginning of GPS time. The time units are seconds.

PTIMe:LEAPsecond:DATE?
(From Symmetricom 58503 manual)
Returns the date of the future the leap second (usually UTC June 30 or
UTC December 31)
Note:
But on my Fury, the GPS Motorola currently returns 2005,12,3 : I guess that
it can return the date of last leap second

PTIMe:LEAPsecond:DURation?
(From Symmetricom 58503 manual)
This query identifies whether a leap second is pending, distinguishes
between leap seconds which extend the minute, and leap seconds which shorten
the minute. This query returns the duration of the minute corrected by the
next leap second. The duration units are seconds. Response Returns a value
of 59, 60 or 61: " A value of 59 indicates subtraction of 1 second is
pending. " A value of 60 indicates no leap second pending. " A value of 61
indicates addition of 1 second is pending. Returns the duration of the
minute corrected by the next leap second. ± dd

SYSTem:COMMunicate:SERial:ECHO   <ON | OFF>
Enable echo on RS-232

SYSTem:COMMunicate:SERial:BAUD   <9600 | 19200 | 38400 | 57600 | 115200>
Setup RS-232 serial speed
The serial configuration is always 8 bit , 1 stop bit, no parity, no Hw
control

QUIT
HELP