Fotech Solutions

Helios Field Engineer's Manual

Prepared by: Steven W. Klassen

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WARNING!

This document is intended for Fotech use only and should NOT be given to customers. The items customers are allowed to configure are described in the appropriate user manual. This document describes further configuration that can be done but that the customer should not be changing.

Fotech Solutions (Canada) Ltd.

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Executive Summary

Objective

The purpose of this document is to describe configuration and customizations that can be made for a customer, but that we do not want the customer to be able to make. Typically the changes described here should be made before the system has left the factory. In a future version (perhaps later this year depending on priorities) we will add a licensing system that will ensure that the customer cannot change these items, but for now the only means of ensuring that is by not telling them about them.

Intended Audience

This document is intended for those ***Fotech employees*** who are charged with setting up a Helios system.

If you are reading this document, you should also read the Helios Configuration Manual. In essence this document is an extension on that one. You may also want to read the Helios Communications document which describes how to get a Helios unit to communicate with a third party software.

Logging In

With Helios 4.2 and later we now have the ability to support username/password logins with various levels of protection. We don't go into the details of what the levels mean in this document as that will be described separately in the user's manual. What we will describe here throughout the document are the things that are available to the factory user that are not available to other users.

New in V4.2 Note that the pre-4.2 method of "logging in" by including "/view" or "/factory" in the URL is no longer supported.

To login as the factory user, use the name "factory" and the password "fotechf00" (by default - the password can be changed on any given installation).

You can tell that you are logged in as the factory user by noting if there is a "Factory" menu available. If not, logout using the "swirl" menu's "Logout" function, then login as the factory user.

The other user that is always there is the admin user. This has the username "admin" and the password "admin" (by default - this should typically be changed by the customer when they receive it). The admin user is considered a company admin. That is, this is the most powerful setting available to our customers. They should never see the factory options or even realize that there is such a thing as a factory user. (The factory user is not listed in the user list unless you are actually logged in as the factory user.)

Factory Settings

BIOS & OS Settings

The items in this section are to be done for Helios units that are included as part of a rack mounted Helios/Panoptes configuration. They are typically not done for a standalone Helios unit that is just shipped to a customer, who presumably would have their own decisions regarding these settings.

Configuring the auto-start on power up

Most of the time when we send a Helios unit to the customer, we do not have it auto-start on power up. However for a rack mounted system where the Helios unit is part of a larger system (specifically when it is being monitored by a Panoptes unit) it is important that the system properly start when the system is powered up.

The specific details of the BIOS settings seem to change some from one version of the motherboard to the next so the details given here may differ some. But they tend to be similar enough that you should be able to determine the correct setting.

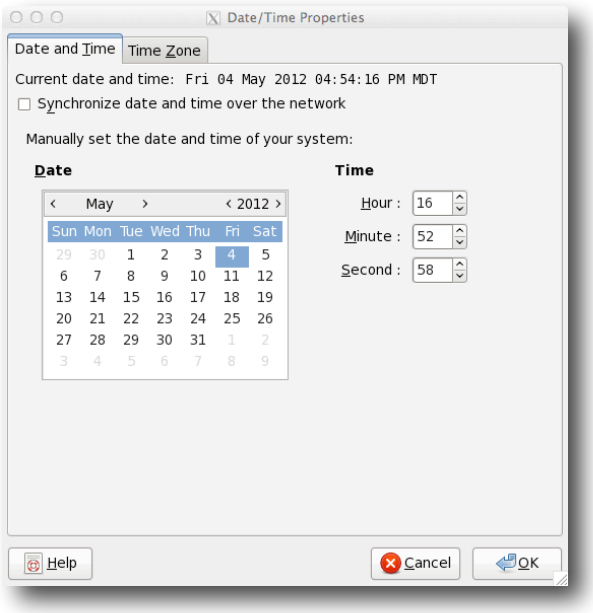
You need to reboot the machine and press the [Del] key in order to enter the BIOS settings. Then go to the “Power” menu and for the item “Power Failure Recovery” set it to be “Always On”. In addition if there is a setting referring to the front panel power button set it to do a controlled shutdown instead of an immediate power off. (The system we have here in Calgary does not have this option so I can’t tell you exactly what it is, but I did see it on the systems for a recent FAT so I suspect that newer BIOSes have it.)

Setting the IP address

To change the IP address run the command “system-config-network”. This provides a GUI that allows you to configure any network cards that have been detected in the system.

Changing the time zone

In order to change the time zone, to set the correct time, and possibly to turn on the time server access you will need to login to the unit as the root user and run the command “system-config-date”. This will bring up the Date/Time Properties dialog of the Linux OS as shown here.



The dialog is fairly straightforward and consists of two tabs, one called “Date and Time” and the other called “Time Zone”.

In the “Date and Time” tab you can choose to either manually set the date and time or to automatically synchronize the date and time over the network. If you choose the latter then your machine must be connected either to the internet in order to access one of the standard time servers.

The “Time Zone” tab allows you to specify the time zone for the machine. Our software attempts to store all times in UTC (GMT) but display it in the local time zone of the users browser. (The display can be changed on a per-browser basis via the preferences dialog in the Helios Web Interface as shown here.) In this way times are kept consistent regardless of where your machines and browsers are located. This is especially important if you have multiple Helios units scattered in various time zones or if you access them remotely, possibly from other time zones.

When you are happy with your settings on both tabs, press the “Ok” button at the bottom of the dialog.

Warning: If the time zone setting does not properly match the date and time that you have set in this dialog, then people browsing from other time zones will show incorrect and confusing

Setting the keyboard type

When a new Helios system is received from the UK, it typically is set for a UK keyboard. Unless you happen to have a UK keyboard plugged into the system you will find that a number of keys are not where you expect them to be. You can change the keyboard type by running the command “system-config-keyboard”. This will bring up the dialog shown here. Scroll the list until you see the keyboard type you want and press the “OK” button.

Note: The keyboard setting only affects a keyboard that is physically connected to the Helios unit. This setting has no affect on the keyboards of machines that are logging into it remotely using the SSH protocol.

The System Configuration File

One of the most significant changes from 3.4 is found in the configuration file. No longer do you have to setup a properties file based on the hardware that is being used. With 4.0 the hardware being used is detected automatically. This does not mean there is no configuration file. It does mean that most of the time you can simply use the provided baseline file. In rare instances you will want to modify some of this file in order to match the custom requirements of a given installation.

Note: *This file is not overwritten with each new software install. If the file does not already exist then it will be created by copying in system_configuration.yml.baseline. Otherwise it will be left alone. If there are edits that you need to make when upgrading software (e.g. if we add new items that need to be there) this will be documented in the appropriate release notes.*

The new configuration file is found in /usr/local/Fotech/etc/system_configuration.yml. This completely replaces the old cncd.properties which (if it is still there) is simply ignored. Unlike cncd.properties the system_configuration.yml does not contain the details of the hardware. Those details are instead read directly from the hardware and automatically stored in the database for use by the system. Instead the system_configuration.yml file is used to describe changes in a given setup from the default. This implies that most of the time you will just leave this with its default values. The exceptions are when you want to limit or modify the behavior of the system.

Also unlike cncd.properties this is a YAML file instead of an XML file. As such it is easier to edit and the comments you will find in it make it largely self-documenting. The next few paragraphs will give you an overview of the different sections of this document, but most of the details I leave for the comments in the file itself.

Note: *After making edits to this file you will need to restart CNCD and possibly HWI (depending on which properties have been changed). You do not need to restart the box as in previous versions. Instead type (as root) "system cncd restart" and "system helioswebd restart" to force them to reread the configuration file.*

System Properties

The "properties" section defines some settable items used to customize the overall behaviour of the system such as the frequency of the heartbeats and the location of the root data directory.

heartbeat_frequency - The 3.4 software sent out its heartbeats at a much higher rate of 1 every 5 seconds. With 4.0 we have reduced this to 1 every 15 seconds but we have added additional heartbeats when significant events occur (such as when FDEL is started or stopped or when the user changes the /HeliosData mount point). The result of this change is that we have a much more responsive system from the user's point of view while sending less traffic. However some third-party software may not like the longer pause between heartbeats in which case you can change it here to make it work more like the previous version.

root_data_directory - The top level directory used for logging. By default this will be /HeliosData.

view_refresh_interval - In view only mode the browser will automatically refresh itself every this number of seconds. This ensures that unmonitored systems do not slow over time due to memory leaks. The default value of 86400 means every 24 hours.

default_event_clear_time - The number of seconds that events (disturbance alarms) will be present on the screen before being automatically removed. The default value is 60. Note that this can be overridden by individual users in the preferences dialog.

warning-disk-space - This is the percentage of disk full at which point we will start the visible warning (the spinning dialog). At this value +5% the system will start sending out the system alarm XML messages and at this value +10% the system will automatically shut down FDEL. The default value is 85.

backscatter_write_interval_s - This is the minimum number of seconds between backscatter audit writes. The default value of 600 means a backscatter log entry is added every 10 minutes (while FDEL is running). *New in V4.2*

backscatter_seach_range - This property can be used to limit the min and max TEC values that will be used in the backscatter optimization. Ultimately we want this to be read from the hardware but for now (V4.2) it needs to be set manually. It should be of the form min,max where the min and max values are obtained either from a spec sheet or by using the dynamic controls to find the range. What we want is for min to be the minimum TEC value that the LDTC will not replace and for max to be the maximum such value. For example on Nellie I found that a value of 5.98 would give little response but 5.97 would suddenly give a good response. This implied that 5.97 was out of range hence the LDTC was using its default level. Similarly, I found that 6.37 gave little response but 6.38 gave a good response. (The optimal value for Nellie was about 6.19-6.22.) Hence for Nellie we set this value to "backscatter_search_range: 5.98,6.37". ***Note****: With newer v2 and v3 optics, this value will not be used and can just be left at the default. The newer optics units read the necessary values from the optics unit itself. It is only the 4U HS units that need this range to be set.*

Communications

The "communications" section defines the host name and ports used to connect the various components of the system. ***For the most part you shouldn't change these***. Typically the only ones who change them are developers who want to make parts of one system talk to their development versions on a different system.

Also note that if you make changes here (say for example because a company does not want to allow anything on port 80 so they want you to make the web available at a different port) you will also need to make similar changes in the firewall settings of the host machine. Simply changing a port here will not do that.

cncd_host - HWI uses this value to determine what machine it should talk to to find CNCD. The default value of 127.0.0.1 refers to the local machine (from the point of view of the web server, not the web browser). Developers sometimes change this to have their development version of HWI talk to a different CNCD (on another machine).

fdel_host - HWI uses this value when it needs to talk to FDEL. The default value of 127.0.0.1 refers to the local machine (from the point of view of the web server, not the web browser). Developers sometimes change this to have their development version of HWI talk to a different FDEL (on another machine).

web_port - This is the port that the HWI web server is found on. Developers sometimes change it to run different HWIs on different ports.

control_port - CNCD listens on this port for the XML commands sent by HWI or by third party systems.

fdel_tcp_port - FDEL uses this port to push data to CNCD synchronously. (e.g. the disturbance alarms)

fdel_dpt_port - FDEL listens on this port for the dynamic properties that are sent from CNCD.

accum_energy_port - FDEL uses this port to send the accumulated energy display to HWI.

pushdaemon_port - CNCD sends binary data over this port. You can listen to this port using the fmessage_viewer program described later in this paper.

websocket_port - CNCD sends the web socket version of the data over this port. You can listen to this port using the wsterm program described later in this paper.

fdel_udp_port - FDEL uses this port to push data to CNCD asynchronously. (e.g. status messages)

micro_debug_port - On a two-box system CNCD listens to this port to receive commands to send to the microcontroller. You can access this port using the wsterm program described later in this paper. You can set this to 'none' if you don't want to allow the debugger. But generally you should leave this alone as only factory users can access the menu item anyway. *Note: You do not need to set this to 'none' on Apollo (playback only) machines. The system will automatically recognize that there is no optics unit and will not display the menu item.*

System Components

The "components" section enables/disables components of the Helios system. Most of the settings should just be left to "auto" but there are some exceptions described in the appropriate locations in this manual. (e.g. setting up a playback-only machine)

microcontroller - Set to 'auto' CNCD will automatically determine the type of microcontroller (a two box, a one box GS, or a one box HS are the items that will be detected). The only other valid option is 'none' which will tell CNCD that it should not even look for a microcontroller. (If there is no microcontroller hardware - e.g. in a playback only machine - CNCD will go into an infinite loop of looking for one.)

laser - If set to 'auto' the type of laser will be handled automatically. If there is no laser on a system (e.g. if it is a playback-only machine) then set this to 'none' so that HWI will leave out the laser based controls and so CNCD will not attempt to talk to them.

database - This describes the type and location of the database. Don't ever change this except on the explicit instructions of a developer.

System Testing

This section is intended to allow the software testers to work without a fully operating system by pretending that certain things are there. ***You shouldn't change any of these values except on the explicit instructions of a developer***.

use_pretend_fdel - If set to 'true' then instead of running fdel the fdel_comms_test_script will be run.This script sends out essentially random data for fibre shots and attempts to simulate events. How much it supports changes over time as developers add/remove/modify portions of it based on what they are trying to test.

use_pretend_sim_fdel - If set to 'true' then instead of running sim_fdel the fdel_comms_test_script will be run. Note that this is no longer available as of V4.5 (which merges fdel and sim_fdel into one). *Removed in V4.5*

pretend_laser - If 'true' then the system will pretend there is a laser even if there is not. This differs from the 'laser' setting in 'components'. The setting in 'components' will turn off portions of the UI if the laser does not exist. The 'pretend_laser' setting does not change the UI, it just pretends that there is a laser. Specifically this property causes the CNCD optics functions to return a success code even though they do nothing.

pretend_mux_channels - Set this to the number of channels you want to pretend exist. If this is greater than 1 then a MUX hardware called "Pretender" will be simulated.

optics_type - Normally set to 'auto'. Set this to a string to report that string as the optics type. E.g. "0x02 (HS system)". This is only used by programmers to test that UI items get enabled/disabled properly and should not be used for any other purpose.

firmware_version - Normally set to 'auto'. Set this to a string to report that as the firmware version, e.g. "2.1.1, Jul 12 2013". This is only used by programmers to test that UI items get enabled/disabled properly and should not be used for any other purpose.

System Limitations

This is the section that you need to edit in order to handle licensed limitations for a given customer. At some point in the (probably near) future this will be modified to ensure that users cannot change it - perhaps by encrypting it or at least by adding some kind of license or digital signature - but for now we are relying on the fact that most users won't be poking around in this part of the machine. (And the fact that for them to change this would be a breach of contract.)

max_fibre_length_m - The maximum length of the fibre in metres. Typically this is set to 'none' which means any length of fibre may be used. But some systems are being sold at a lower cost with a 16km limitation. For those machines set this to '16000'.

stream_mode - If set to 'multiple' then the user interface will allow multiple stream. If set to 'single' then the system will only allow one stream to be used at a time.

serialized_event_detection - By default this is 'disabled'. If you change it to 'enabled' then users that have a single stream limitation will still be allowed to use multiple streams by automatically switching between them on a set scheduled. Note that as of the time of this writing management has decided they don't want to offer this functionality so you should not enable this without specific instructions to do so.

enable_lc - Change this to "true" for customers for whom we want to include the level crossing support.

Branding

The branding section allows you to customize the branding portions of our software, including replacing our logo and changing references to Helios and Fotech. Typically this is only done for customers for whom we have a special agreement. The details on how to customize the branding using this section are described later in this document.

The Factory GUI

Factory users have a number of permissions that are not available even to administrative users. Typically these permissions relate to items regarding FAT and SAT test procedures as well as to allow the configuration of items that are not intended to be setup by the customer.

In order to view the factory GUI you need to login as a factory user as described earlier in this paper.

Factory Menu

Perhaps the first thing to notice (and this is also how you can tell that you are logged in as a factory user) is that there is a "Factory" menu available. It contains the following menu items.

Wipe database - This will completely wipe out the database and you will have to setup the machine from scratch. If you do this it will create a snapshot called "Backup from last system wipe" which can be restored in the "Manage Snapshots", so it is possible to recover the system in the case of a mistake. Nonetheless, it is not recommended that you

ever perform the wipe except on the advice of a programmer. It is kind of the “last ditch” effort in dealing with a troublesome machine.

Save as factory defaults - This creates a “special” snapshot of the current properties which is intended to be the factory default values for the given machine. Admin users can reset the machine back to this state by selecting “Reset to factory defaults” from the admin menu. It is recommended that factory defaults be set before the machine is delivered to the customer.

Set system alarm thresholds - This allows the system alarm thresholds to be temporarily modified. The primary reason for doing this is to allow system alarms to be triggered during FAT and SAT tests.

Insert splice - As of V4.3 this menu item has been removed from the factory menu and added as a button in the optical channel properties dialog. In addition, it is now available to admin users as well as factory users.

Changed in V4.3

Microcontroller console - (Only for two-box machines.) This brings up a new window with the microcontroller console. It is used for debugging the new micro and for testing various settings. This is described in more detail later in this paper.

Admin/Hardware Properties Dialog

Identity Tab - This tab is used to identify the helios unit. You should give it a name such as “Helios 6” or perhaps “H1A” or perhaps “La Molina DAS” depending on the targeted use. You should also enter its serial number. If this unit is to be used in combination with a Panoptes unit, then you should enter the Helios Unit ID that was assigned by Panoptes when you created the machine it its interface. Finally you should press the “New” button to generate a UUID that is unique from all other Helios units. In general you should leave the “Custom” fields blank as the ordinary users have the ability to set those.

An important note

Our Helios machines are identified using a globally unique identifier. On a new install the factory defaults will start with properties that are the same on all machines - including this identifier. It is important that you *at least* change the UUID and save the properties as well as save the properties as the factory defaults so that the machine can be uniquely identified.

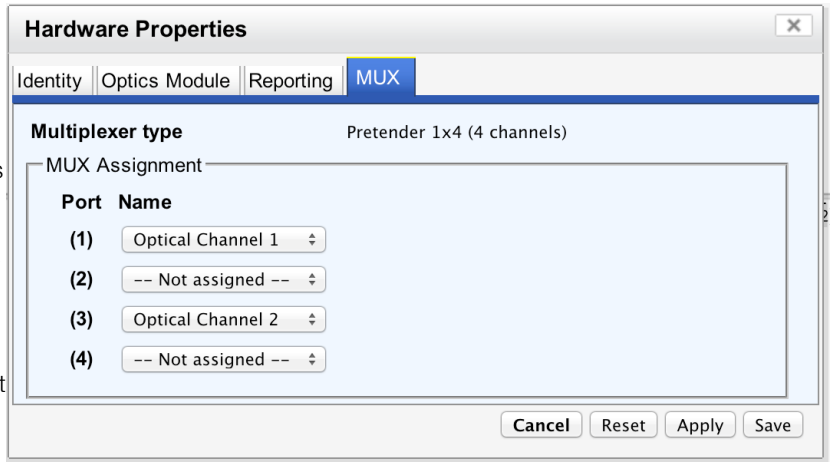
Note that only factory users can modify most of these settings. Only the “Custom” fields can be set by admin users.

Optics Module Tab - The items that must be set include the trigger level and the box delay. In addition there may be other editable items depending on the type of the optics module. These are not described here.

Changed in V4.5

Everything else in this tab is read automatically from the hardware and displayed here in a read-only fashion. Note that only factory users can set these. For admin users this entire tab is read-only.

MUX Tab - This will only be seen if the system includes a MUX unit and it will never be seen by non-factory users. They will see the MUX capability by the addition of the channel selection controls in the main user interface.



At the top of the panel will be the type of MUX unit that was detected, including the number of channels available. ("Pretender" is the MUX type that you get if "pretend_mux_channels" was set in the system configuration. Users should never see that but I didn't have a real MUX unit available when I wrote this so this was the only way I could get a screen shot.)

Originally I had hoped this panel would not be needed and that we could automatically detect the number of channels in the system. However I was informed that many (all?) of our 2-channel systems actually have a 4-channel MUX but only have two of the channels physically connected. This implies that CNCD cannot automatically determine the necessary information and it must be configured using this dialog. (*Future consideration: Should this be built into the new microcontroller?*)

The main portion of the panel is the "MUX Assignment" where you specify which MUX ports are physically connected by assigning them to "optical channels". The "optical channels" are the view that the users will see and are automatically mapped to the correct ports. This implies that if there are more MUX ports than we are making available to the user that we can choose the ones that provide the best signal and make them available rather than always using the first ones. Perhaps more importantly if a port degrades it could be replaced with an available one by changing the physical connections and then modifying this panel appropriately. In this way it may be possible to repair a "broken" MUX simply by using a port that was not previously connected. Note that the "optical channel" ordering does not have to match the port ordering. Hence if there is a significant difference in the quality of the ports you can choose the best one and assign it to "optical channel 1" so that it becomes the one used by default.

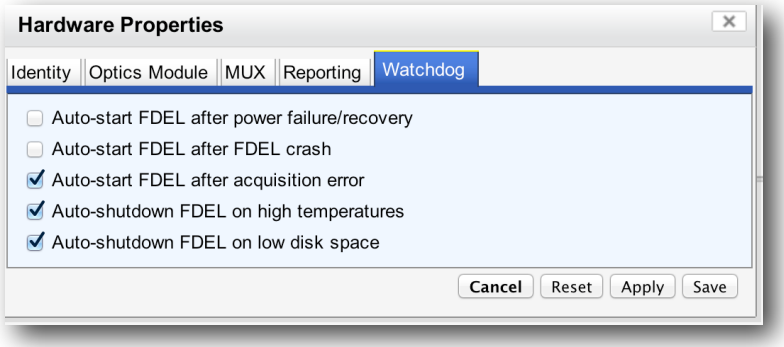
Reporting Tab - In general the XML submission should all be turned off. Customers can turn this on themselves if they are planning to use the XML protocol so send information to one of their systems. The binary submission type should be turned off if this is a standalone system but should be turned on if this is being used with a Panoptes system. In that case the host name or IP address of the Panoptes system should be entered, the port should be 5000, and submit disturbance alarms should be turned on. You can also turn on the submit fibre shots, but we prefer that people use HWI to view the fibre shots instead of the sound field on Panoptes. One the other hand if you have a good connection and want to see the live fibre on the map, you would need to turn on the fibre shots.

Changed in V4.5

This entire tab may be modified by both factory and admin users.

Note that as of V4.5 there is only a single URL field which is applied to all types of XML submissions. The recipient must examine the received package to determine the object type.

Watchdog Tab - The Helios software contains a certain amount of internal watchdog ability. This tab is used to enable or disable that ability.



The following watchdog options are currently available.

Note that only factory users see this tab, it is not available to admin or basic users.

Auto-start FDEL after power failure/recovery - Turning this on will cause the system to keep track of whenever FDEL is currently running. If the system fails catastrophically (e.g. a power failure) then when it is started again CNCD will detect that FDEL had been running when it failed and will automatically start it again after about a 30 second pause (to allow things to stabilize). The option is off by default but is typically turned on for pipeline and security installations where the system is expected to run 24/7.

Auto-start FDEL after FDEL crash - Turning this on will cause CNCD to automatically restart FDEL if FDEL exits either with an error code or in a crash (segmentation fault). Note that if FDEL is regularly crashing due to some problem this will cause an infinite loop of crashes and restarts. (This will be recorded in the audit log.) The option is off by default but is typically turned on for pipeline and security installations where the system is expected to run 24/7.

Auto-start FDEL after acquisition error - While we are discussing this problem with Alazar and are hoping to solve it so we don't get these errors, in the meantime FDEL has the ability to automatically reset the acquisition and restart itself when this error is detected. This is done internally in FDEL and is much quicker than relying on CNCD to restart FDEL. (Note that if you turn this off but have the *auto-start FDEL after FDEL crash* turned on, FDEL will get restarted by CNCD. But it is a slower process of several seconds compared to using this option.) The option is turned on by default but should be turned off for seismic installations or any other situation where halting the acquisition and having an operator deal with the problem is preferable to automatically restarting it (which is **not** reflected in the logged data).

New in V4.1.3

Auto-shutdown FDEL on high temperatures - Turning this on will cause CNCD to shut down FDEL if the CPU temperature is too high. This is an effective way of bringing the temperature down without shutting off the machine since the bulk of the heat is generated by the GPU while processing. The definition of a high temperature is built into the CPU itself and can be viewed by running the command "sensors" in a shell window. Typically the high is defined around 75 to 85ºC. When this temperature is exceeded the user will get a warning in the form of a spinning warning icon in the "CPU temperature" portion of the UI. At 5º over this temperature the Helios unit will start sending temperature system alarms via the external comms and XML interfaces (see the *Helios Communications* manual for details on the message formats). At 10º over this high temperature mark CNCD will shutdown FDEL if the auto-shutdown is turned on. This option is turned on be default and should only be turned off if a customer has some other system that is monitoring and dealing with temperature alarms.

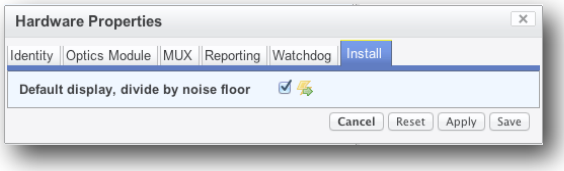
Auto-shutdown FDEL on low disk space - Turning this on will cause CNCD to shut down FDEL if either the root or the logging drives become too full. By default the disk space warning limit is 85%full but this can be changed by setting the "warning-disk-space" property in the system configuration file (described earlier in this paper). When this warning disk space is passed the user is given an initial warning in the form of the spinning warning icon in the "Drive usage" portion of the UI. If the disk continues to fill past 5% more than this cutoff CNCD will start

sending out disk space system alarms via the external comms and XML interfaces (see the *Helios Communications* manual for details on the message formats). At 10% more than this cutoff (i.e. 95% full if the default has not been changed) CNCD will shut down FDEL if this auto-shutdown has been turned on. This option is turned on by default and should only be turned off if a customer has some other system that is monitoring and dealing with disk space alarms.

Install Tab - This tab is only viewable by factory users and contains installation options that should be set by the factory. Right now there is only one item in it, but I expect we will add more over time, largely replacing the existing system_configuration.yml file.

New in V4.2.2

Currently the only option in this tab is "Default display, divide by noise floor" which should almost always be checked. If unchecked then the default display will multiply by the noise floor which is an option that Halliburton wanted but that we really don't want anyone else to use. (It makes for a much noisier default display.)



Admin/Optical Channel Properties Dialog

Top Section - If this is used in conjunction with a Panoptes unit, factory users can set the fibre line id as specified in Panoptes in this dialog. Note that this needs to be set separately for each channel (in a MUX system).

Optics Tab - Admin users can set most of the optics properties with the exception of the TEC1 controller set point which is only settable by the factory user. The properties can be set either statically or dynamically. In addition the TEC1 controller set point can be optimized (most of the time) by pressing the "Optimize" button. That process is described in more detail later in this paper.

New in V4.2 Note that the dynamic editing of the optics properties, the "Optimize" button, and the fast noise floor estimate were not available in pre-4.2 versions of the software.

Processing Tab - Factory users have one option in this tab not available to others. "Enable fast noise floor estimate" allows a faster noise floor estimate to be used provided that most of the signal is below 1/2 Nyquist which is typically the case for buried fibre. This means that for most buried fibres this option should be enabled and for most downhole well applications it should be disabled.

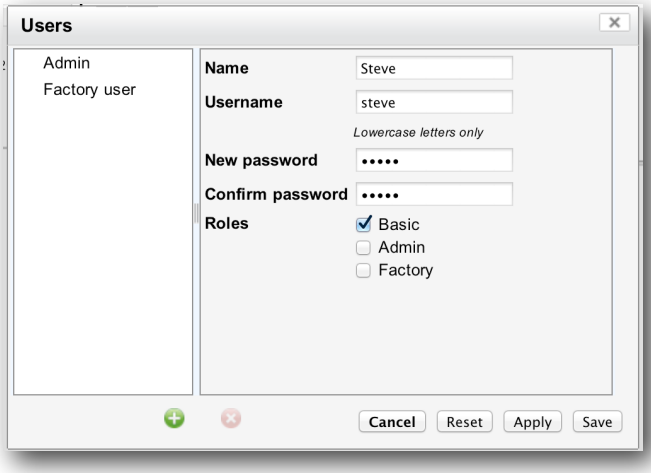
Admin/Detection Statistics and Indicators Dialogs

Factory users have an additional option over other users in that they can mark specific *Detection Statistic* or *Indicator Cleanup* items as being templates. Administrative users can view and use the templates, but they cannot edit them. If they want to change properties they need to copy the template (using the "Save as" button) and make their changes in the copies.

Admin/Manage Users Dialog

The only addition in this dialog for factory users is that they can see the factory user and can assign the

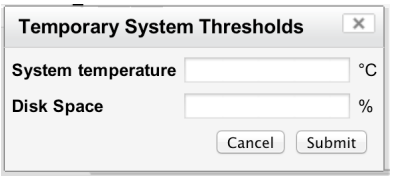
New in V4.2



factory permission. Admin and basic users are not allowed to even see the existence of the factory user and cannot assign the factory permission.

Note that even the factory user cannot delete the "factory" or "admin" users and cannot even change the username or roles. The name (which is the visible name) and the password can be changed. The purpose behind this is to ensure that the "factory" and "admin" users will always exist.

Factory/Set Temporary System Thresholds Dialog



This dialog is used to temporarily change the thresholds for the temperature and disk space alarms. The thresholds will be changed only as long as the dialog is visible - closing it either via the "Cancel" button or the "X" button will reset the thresholds back to their production values. This was done to ensure that lower thresholds are not accidentally left on a production machine.

Note that this only changes the threshold, it does not change the warning/alarm message/shutdown procedure. For example, if you set the temperature threshold to 15ºC that will cause the warning icon to appear at 15ºC, the system alarm messages to be sent at 15+5=20ºC and the FDEL shutdown to occur at 15+10=25ºC. Similarly for the disk space threshold this defines when the warning icon appears, the system alarm messages and FDEL shutdown at this value +5% and +10%, respectively.

The typical use case for this dialog is for proving the alarming functionality in FAT and SAT procedures.

Factory/Microcontroller Console Window

This opens a new browser window with the microcontroller console. It is described in more detail later in this paper, in the troubleshooting section.

System Health Panel

Factory users will see one additional item in the *System Health* panel. Specifically the "Mean backscatter" value will be displayed at the bottom of the panel. This is described in more detail later in this paper. *New in V4.2*

As of V4.5 factory users will see a "Health Details" button in this section. This button will bring up a separate window that shows a list of all reported system health details. The exact contents of this window can change over time, but typically includes the GPU and CPU temperatures, how full the drives are, type type of GPUs, etc. *New in V4.5*

Installing the 10Gig-E Option

In theory this should have been done at the factory during the initial Helios setup. But in some cases a customer may purchase it after the fact and you will need to do this in the field. There are basically two things you need to do - install the card and driver in the Helios machine, and setup and provide the customer with a USB stick including the drivers, documentation, and sample code for their client machine.

Preparation

To complete this you will need not only the two 10Gig-E cards (one for the Helios and one for the client machine), but also the drivers and example software. These are available on the dropbox in “Software Releases/10GigE Installation”. They are also available in "040_Software/400_Software/Software Releases/2014/10GigE Installation” on either the UK or Canadian servers.

Additionally it is always safer to have a screen and keyboard when you are doing driver updates. But they are not necessary so long as nothing goes wrong. Ensure that you know your network settings before you begin.

Helios Installation

Ensure the machine is powered off and remove the lid. Physically install the card into a suitable slot. If possible try not to use a slot adjacent to the CUDA card. Note that you will need to clip the bottom of the cards' bracket in order to physically fit into a 3U Helios box. Replace the list and power up the machine.

Next copy the file 19.3_OEM.zip (available in the locations mentioned above) into /tmp and extract it. Then go into “19.3_OEM/PROXGB/LINUX” and extract the file “ixgbe-3.21.2.tar.gz”. Then go into “src” and type (as root) “make install”.

Reboot the machine. When it comes back type in “lspci | grep Ethernet”. If the driver was properly installed you should see the new device in the list and can put the lib back in place.

Configure the New Network

This can be done either using “system-config-network” or by adding/editing the configuration file in /etc/sysconfig/network-scripts.

Either way the first step is to find out the name of the device. Type in “ifconfig” and look at the results. The 10GigE card should be a device with the name that looks like p?p?. The first ? will be a number indicating which slot the card was plugged into and the second ? will be the number of the port on the card (typically 1). Let’s assume that it is p3p1 for this example.

Either create a new network in system-config-network or create/edit the file ifcfg-p3p1 in the network-scripts directory. (If it doesn’t exist, copy one of the others as an example. You can also create it using system-config-network and edit it afterwards.) In any event give it an IPADDR of 192.168.50.100, a GATEWAY of 192.168.50.1, and a NETMASK of 255.255.255.0. You also need to ensure that “ONBOOT=yes” (this doesn’t seem to be done automatically using system-config-network, so if you are using the UI be sure to check the file afterwards. If you had to create it from scratch then also ensure that HWADDR is set to the value given by the “ifconfig” command.

Once done type in “ifdown p3p1 ; ifup p3p1” (as root). At this point you should be able to connect the card to another machine and, once it’s networks is configured, ping it.

Assisting the Customer with the Client Machine

Hopefully the customer knows how to install cards and configure networks on their machine. In any event you should obtain a USB key and copy the contents of the “10GigE Installation” directory onto it. Provide it to the customer together with the second 10GigE card. It should contain two items…

19.3_OEM.zip - these are the Intel drivers and instructions which they may need. (Windows 7 seemed to pick up the card without any additional drivers. Older versions may need this.)

Docs - Contains the Helios Communciations Manual, which includes a chapter on the high speed streaming, plus the streamviewer.c example program.

Customizing the Software

Customer Specific Limitations

There are three customer limitations that are currently supported. At present all three are implemented by modifying the system_configuration.yml file and there is no actual protection other than we don't tell the user's about it. That is expected to change in version 5 of the software when we add a licensing scheme.

Playback Only Installations (Apollo?)

There are two goals that we must accomplish for playback only installations. First, we need to ensure that CNCD does not remain in an infinite loop looking for an optics unit that will never be found. Second, we want to remove the "live" portion of the user interface so that the system will go immediately into playback mode.

1. In the "components" section of the configuration file set both "microcontroller" and "laser" to read "none".
2. Restart the servers. ("service cncd restart" and "service helioswebd restart")
3. Refresh any browsers. At this point the UI will limit the user to 16km fibre lines.

Short Fibre Optics

One of the fairly common customizations is to limit the possible fibre lines to 16km. This is accomplished by modifying the system configuration file described earlier in this document. Specifically to provide a short fibre license you need to perform the following steps.

1. Edit the /usr/local/Fotech/etc/system_configuration.yml file (you will need to be root). Look for the tag "max_fibre_length_m" in the "limitations" section and change it from "none" to "16000".
2. Restart the servers. ("service cncd restart" and "service helioswebd restart")
3. Refresh any browsers. At this point the UI will limit the user to 16km fibre lines.

Single Stream License

A single stream license means that 4.X software can be run, but only one stream is allowed to be configured at a time. The users can still make full use of the templates to switch between different settings, but only one of them will be active at a time.

1. Edit the /usr/local/Fotech/etc/system_configuration.yml file (you will need to be root). Look for the tag "stream_mode" in the "limitations" section and change it from "multiple" to "single".
2. Restart the servers. ("service cncd restart" and "service helioswebd restart")
3. Refresh any browsers. At this point the UI will limit the user to 16km fibre lines.

Customizing the Web Interface

Introduction

For the most part the Web Interface does not require configuration. It is accessible on port 80 and has no dependance on the name of the URL (i.e. no virtual host name requirements). For the most part the only reason that you would need to change any of this is if there are odd network requirements in a given installation that require changing the ports. However given that the Helios unit is essentially self-contained, this is not a likely requirement.

Typically after modifying the customizable parameters you will need to restart the web interface. To do this use the following commands as root. To issue these commands you would need to be logged into the Helios unit as the root user. Logging in is described in the introduction to the "Customizing the Hardware" chapter.

```
service helioswebd restart
```

Any browsers that are currently pointed to the machine will inform their users of the change, automatically go into a waiting mode, and will automatically refresh when the web server has started up again.

The /usr/local/Fotech/etc/webstorage Directory

The web software is installed in the /usr/local/Fotech/web directory and every time a new version is installed this directory is replaced. (Specifically a new directory is added and the /usr/local/Fotech/web/current symbolic link is changed.) This implies that any changes you make in this directory would be lost the next time you install a software update. For this reason any customized configuration must be placed in the /usr/local/Fotech/etc/webstorage directory as it persists between software version updates. The following is a summary of what you may find in that directory.

- colourmap.json - A representation of the current colourmap. Created automatically by the web software. You should not change or remove this file. (Although the web software will automatically recover if you remove it, it will result in the loss of your colourmap and its replacement with the default colourmap.)
- customer_branding.png - An optional file used to provide customer specific branding.

Some of these are described in more detail below.

Customizing the Branding

Changed in V4.4.4

With V4.4.4 we have reworked our Helios software branding. Specifically we have removed the permanent branding region (formerly in the top right corner) in order to make that real estate available to the general UI. We have replaced it with a "splash screen" that shows up briefly each time the web UI is started or the page is refreshed.

As part of this reworking we have also made it possible to replace all the Fotech-specific branding in the UI. (Previously you could only change the image in the branding section.) To do this you need to have root access to the system so that you can edit the file /usr/local/Fotech/etc/system_configuration.yml. Within this file you will need to edit the "branding" section. If you are dealing with a new install then the branding section will already exist. If you are upgrading an existing system it will not exist and you will need to create it. The default branding will look like the following which you can cut and paste into the file.

```
# BRANDING
# This section concerns itself with the labeling present in HWI
# corporate_name: the name that will appear on the bottom copyright notice
# corporate_name_short: used primarily when conveying that the user should contact support
# coporate_website: will be linked from the product logo in the about box
# product_name: will replace "Helios" in as many places as possible
# product_logo: will show up in the about_box  (width is limited to 150px)
# product_logo_for_menu: will show up as the main menu item (should be 16px x 16px)
branding:
   corporate_name: Fotech Solutions Ltd.
   corporate_name_short: Fotech
   corporate_website: http://www.fotechsolutions.com
   corporate_support_email: techsupport@fotechsolutions.com
   product_name: Helios
   product_logo: /images/fotech_branding.png
   product_logo_for_menu: /images/logo-small.png
```

Once you have this section in your file you edit the various entries appropriately and type “helios restart” in order to make the changes take effect. (You may also need to refresh your browser.)

The following describe the meaning of each of the entries...

corporate_name & corporate_name_short - These provide a long and short version of the company name shown in the copyright line, the splash screen and a number of other places.

corporate_website - The website to connect to when the user clicks on the product logo in the about box.

corporate_support_email - The email address that problem reports will be sent to when the user clicks on the “report a problem” menu item.

product_name - The name given to a “Helios” unit.

product_logo - The logo shown in the about box and the splash screen. To change this you should create the directory “/usr/local/Fotech/etc/webstorage/images” if it doesn’t already exist and copy your image into that directory. You can then refer to you image in the branding using the prefix “/images/custom”. So, for example, if you have the file “/usr/local/Fotech/etc/webstorage/images/mylogo.png” you would need the setting “product_logo: /images/custom/mylogo.png”. Note that we will scale the image to a width of roughly 250 pixels (or slightly smaller) so it is best if you create it with roughly that size.

product_logo_for_menu - This is the small image (should be 16x16 pixels) that is displayed as the “swirl” menu in our menubar and also (by most browsers) in the URL or tab section of the browser. To change this you should create the directory “/usr/local/Fotech/etc/webstorage/images” if it doesn’t already exist and copy your image into that directory. You can then refer to you image in the branding using the prefix “/images/custom”. So, for example, if you have the file “/usr/local/Fotech/etc/webstorage/images/mySmallLogo.png” you would need the setting “product_logo: /images/custom/mySmallLogo.png”.

Note that there still are a few areas that contain the “Helios” branding. At present we have no intention of changing these:

1. The copyright comments in the web page source code (seen if the user opts to “view source” on their browser). We are leaving this in place as the users typically do not see this and because we do not want to release the copyright on our actual source code.

2. The acronym FDEL - stands for “Fotech Distributed Event Locator”. These are found in the version strings and in a few error messages that may be shown to the user. You can always tell the client that it stands for “Fibre Distributed Event Locator”.

3. The acronym HWI - stands for “Helios Web Interface”. I can’t presently find any location that shows this acronym, but it may show up in some error messages.

Customizing CNCD

Location of CNCD Files

In a default installation the CNCD (command and communication daemon) relies on a number of files.

- /usr/local/Fotech/bin/cncd - This is the CNCD executable. Or more accurately this is a symbolic link to the executable. You should not change this unless you really know what you are doing.
- /usr/local/Fotech/etc/log4cxx.rc - This file is used to configure the logging system. By default this will log information, warning, and error messages to the file /var/log/Fotech/cncd.log. You should not change this unless you know what you are doing.

Customizing FDEL

Location of FDEL Files

With a default installation FDEL depends on a number of files as shown below:

- /usr/local/Fotech/bin/fdel - This is the FDEL executable. More accurately this is a symbolic link to the current FDEL executable. This is typically setup by our install scripts and should not be changed. However if you are given a custom FDEL for some purpose you would copy it into this bin directory and change this symbolic link to point to it. Note that this would be undone the next time you run an install script.
- /usr/local/Fotech/etc/properties/fdel.properties.output - FDEL uses a properties file to define specifically what it should do. The fdel.properties.output is a properties file that is automatically generated by CNCD based on what the user has specified in the user interface. Typically you should not change this manually, but if you are going to run FDEL or SIM_FDEL manually you can copy this file and make your changes to the copy. A detailed description of all the possible properties is found in the “FDEL Property List” document.
- /usr/local/Fotech/etc/properties/fdel.properties.overwrite - This file contains FDEL properties that are added to the system *after* the values from the user interface are added. This can be used to handle new items that are not in the user interface or to force certain behaviours for a given installation. Typically it is empty. There are also “initial” and “v34” versions which should not be edited but are supplied by the developers as part of the system.

- /usr/local/Fotech/etc/log4cxx-<program>.rc - This file is used to configure the logging system. There is a separate configuration file for cncd and for fdel and we may add additional ones in the future. You should not change these unless you know what you are doing. Also they are overwritten with each new software upgrade so any changes you make will only be temporary.

Handling Legacy Installations

We continually try to improve the signal to noise ratio of our system. A better S/N generally means we can get more accurate event detection and tracking. *New in V4.5*

However, a change in the S/N also means that a system that has already been setup and configured will suddenly appear to have a more sensitive signal, messing up what could have been many man-months of configuration effort. To avoid this, we now include what we are calling “legacy” properties which can be used to force the older behaviour.

These “legacy” properties will need to be set in the fdel.properties.overwrite file as described above. To make it easier to ensure they are correct all the possible “legacy” properties can be found in the file /usr/local/Fotech/etc/fdel.properties.overwrite.baseline. This file is rewritten with every install so it will always contain all the supported “legacy” properties. To enable a “legacy” property copy the property of interest into fdel.properties.overwrite and remove the comment character in front of it. As a sort of “double check” make sure that the property is set to “TRUE”. The TRUE values means that you are turning on the “legacy” behaviour instead of allowing the new behaviour.

The following describes all the “legacy” properties currently allowed. This information is also found as comments in the .baseline file mentioned above.

legacy.tracking.allowPredictionWithSingleEndpointMatch

Allow alarm (event) tracking predictions based on a single endpoint match. If only one endpoint matched the resulting event track could have a negative size or a size exactly twice its position (depending on which endpoint matched). This was logged as bug#3162 and has been corrected in V4.5.0, but the correction could lead to the posting of events that were previously ignored, hence the need for allowing the legacy behaviour.

legacy.spaceTimeAnalysis.allowNegativeTemporalDecomposition

Temporal decomposition with large preconditioning half-lives could result in negative values for the impulsive component. This results in a dark shadow on the trailing edge of some impulsive events. This has been fixed in V4.5, but the fix could mean that some impulsive events seem longer than they used to, possibly messing up the filter settings.

Troubleshooting

Resetting Permissions

Our software is design so that the usernames “factory” and “admin” always exist. However it is possible that the users could change the passwords for these users. If they do that and we forget what the passwords are, you can reset the factory password back to it’s default values of “fotechf00” by doing the following on a Helios shell command line window.

```
su -
cd /usr/local/Fotech/web/current
rake reset:factory_password
```

Once you have done this you can login as the factory user and change the password for admin or any other user.

The Log Files

All the log files are found in /var/log/Fotech, except for the OS system log which is found in /var/log/messages. The following describe the Fotech specific log files. Note that many (but not all) of the files will keep up to 9 older copies on a rotating basis.

- *audit.log* - An audit trail that describes every disturbance alarm, FDEL start and stop, and various other items that may occur. There is no configuration for this file.
- *backscatter_level.log* - This file contains timestamps followed by a mean backscatter level separated by a comma. The measurements are taken roughly every 10 minutes. There is no configuration for this file, except that you can turn it off as described later in this paper.
- *backscatter_optimize_<timestamp>.log* - These files contain a log of what happens each time the factory user runs the automatic TEC optimization. There is no configuration for this file.
- *cncd.log* - Describes what is happening in CNCD. You can configure the information in this log by editing the file /usr/local/Fotech/etc/log4cxx-cncd.rc. Typically the item you may want to change is changing the level from INFO to DEBUG on the last line of the file.
- *fdel.log* - Describes what is happening in FDEL. You can configure the information in this log by editing the file /usr/local/Fotech/etc/log4cxx-fdel.rc.
- *heliosweb.log* - Describes what is happening in HWI (the server, not the client side operations). There is no configuration for this file.
- *microcontroller.log* - Provides the LOG messages that have been received from the microcontroller. Although this can be configured some via /usr/local/Fotech/etc/log4cxx-cncd.rc, you really shouldn’t change anything. It is intended that

changes in logging level for the micro controller would be handled by sending commands to the micro controller via the debugging terminal.

Microcontroller Console

TODO: describe the console

Monitoring the Backscatter Level

Monitoring the backscatter

By default a Helios unit is setup to constantly monitor the backscatter level and log it to a file. This allows us to track changes in the sensitivity of the system over long periods of time. This data is logged to the file "/var/log/Fotech/backscatter_level.log" every 10 minutes. (The time increment can be changed by setting the system property value "backscatter_write_interval_s".)

The log file itself is very simple, consisting of a timestamp and the backscatter level.

```
2013-02-26T16:34:20.070+00:00, 4879.25
2013-02-27T08:41:45.608+00:00, 4943.65
2013-02-27T08:51:47.302+00:00, 4907.75
2013-02-27T09:01:48.411+00:00, 4882.46
2013-02-27T09:11:50.100+00:00, 4853.64
2013-02-27T09:21:51.790+00:00, 4833.18
2013-02-27T09:31:53.479+00:00, 4865.12
2013-02-27T09:41:55.171+00:00, 4883.73
2013-02-27T09:51:56.862+00:00, 4831.89
```

It is intended that you can load the file into Excel or Numbers and plot the time against the level in order to see if the value is changed in some specific manner.

Using the backscatter to optimize the TEC

One of the advantages of computing the backscatter level is that we can use it to optimize the optical settings. Any setting can be optimized by hand by using the dynamic optics controls and watching the backscatter level, but the TEC value specifically can be optimized automatically. To do this bring up the "Optics Module" tab of the "Hardware Properties" dialog and press the "Optimize" button. This will start the process (after a warning dialog) at which point the screen will look like the following:

The process will take a number of minutes to run. During this time the screen will be disabled except for an "Optics Optimization" dialog which will show you the current status and provide a button allowing you to cancel the process.

If the process is successful a suitable message will be displayed to the user, the new TEC value will be written into the database, and the screen will refresh. If it is not successful an error message will be displayed and the values will revert back to their original. The primary reason that the process may not succeed is if the backscatter is turned off, if the optics settings (other than the TEC) are so far off that we get no useful values, or perhaps if there is a physical problem with the system.

Note: In order for this to work properly the system needs to know the valid end points of the TEC search range. This is set in the properties section of the system_configuration.yml file described earlier in this paper. The property that you need to set is the “backscatter_search_range” property.

Turning off the backscatter

While the load from the backscatter computation is not large, it is also not zero. So if you are pushing the unit to the limit on a long fibre line, you may want to turn it off. Obviously you would then need to turn it on again in order to actually use it. Because we do not intend for this to be turned off most of the time, we have not put this ability into the user interface, so turning off the backscatter must be done the “old fashioned” way.

Edit the file “/usr/local/Fotech/etc/fdel.properties.overwrite” and add the following line.

```
reporting.meanBackScatterLevel.enabled = FALSE
```

Then do a “service cncd restart” and when it comes back the backscatter will be turned off. Note that when you do this, the TEC optimization button (while still being available) will always fail to produce a result. We may change this in a future release but for now if you need to run the optimization and have turned off the backscatter for efficiency reasons, you will need to turn it on again before performing the optimization.