NEXUS NX6100/PPC6000 SERIES MODBUS RTU / TCPIP, and BACNET/IP COMMUNICATIONS

DESCRIPTION

The MODBUS interface is designed to connect Fireye's NX6100 or PPC6000 Nexus Controllers to other devices using the 'MODBUS RTU' or 'MODBUS TCP' protocols, using 3 wire RS485. This bulletin shows connections and the available MODBUS memory map for these controls only.

NX6100/PPC6000 series controllers may be connected to a MODBUS communications system to enable data collection and limited control functions. The controllers are connected to the MODBUS via the Isolated RS485 Communications terminals on the NX6100 or PPC6000. The MODBUS function requires a daughter board to be fitted to each controller.

The protocol supported is MODBUS RTU and the data configuration supported is 8-bits, no parity, 1-stop bit. This is the simplest and most common data configuration because the MODBUS protocol includes 'crc' to ensure data packet integrity.

A network of up to 14 Fireye Nexus NX6100 or PPC6000 controls can be linked toMODBUS.

Consideration needs to be given to the total number of registers to be communicated, refer to page 4 for further details.

MODBUS RTU can be accessed via two daughter boards for the NX6100 or PPC6000. The NXDBMB (MODBUS only) or NXDBVSD (MODBUS and variable speed drive) allow access to the NX6100/PPC6000 through the isolated RS485 terminals. See Figure 1, Section 1.2. Also, refer to the appropriate bulletin, NEX-6101 or PPC-6001.

The touch-screen NXTSD104 or NX6330 is required to use BACNET/IP because it provides the Ethernet interface. The protocol is implemented by the firmware running on the touch-screen hardware. BACNET/IP is the only form of the BACNET protocol available for the 6000 series.

Safety Information

WARNING

The equipment described in this manual is capable of causing property damage, severe injury, or death. It is the responsibility of the owner or user to ensure that the equipment described herenis installed, operated and commissioned in compliance with the requirements of all national and local legislation, which may prevail.

When this equipment is fitted to an appliance due regard must also be given to the requirements of that appliance.

Before attempting to install, commission or operate this equipment all relevant sections of this document must be read and fully understood. If in doubt about any requirements consult Fireye.

Installation, commissioning or adjustment of this product MUST be carried out by suitably trained engineers or personnel qualified by training and experience.

After installation or modifications to the installation all functions of the equipment MUST be checked to ensure safe and reliable operation of the control.

The manufacturer of this equipment accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation, commissioning or adjustment of operating parameters of the equipment.

Control panels **must not** be left uncovered while power is on. If it is essential to do so while rectifying faults only personnel qualified by training and experience should be involved.

The time any covers are off must be kept to a minimum and warning notices **must** be posted.

Before attempting any work on this equipment or any equipment controlled by or connected to this equipment, all related electrical supplies must be isolated.

Safety interlocks **must not** be removed or over-ridden. Any faults once detected **must** be corrected before the control is operated.

The manufacturer of this equipment has a policy of continual product improvement and reserves the right to change the specification of the equipment and the contents of this manual without notice.

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Please read the safety information at the front of this manual before proceeding

Introduction

1.1 Compatibility and Conventions

MODBUS RTU communication with NX6100/PPC6000 series controllers is compatible with NX6100 or PPC6000 at firmware revision 1.2 or greater. Engineer's Key EK55 indicates the firmware version. See Section 4 and 6.6 of the relevant NX6100 or PPC6000 bulletin for more information. The NX6100/PPC6000 require the use of either the NXDBMB (MODBUS only) or the NXDBVSD (MODBUS and Variable Speed Drive) daughter boards. These boards are inserted into the NX6100/PPC6000 through the back side. The firmware revision of these boards must be 1.103 or above. Consult the factory to verify the revision level.

Modbus TCP communication with NX6100/PPC6000 series controls requires the use of an Ethernet enabled display module. The NXTSD104 and NX6330 displays provides the required functionality.

If Modbus TCP only is required, then there is no requirement for a daughterboard in the controller unless it is required for some other function (for example fan speed control).

All touch-screens of firmware version 2.100 and higher will provide Modbus TCP. Version 2.0xx screens can be upgraded (firmware update) to provide modbus TCP. Version 1.xxx screens cannot be upgraded to provide modbus TCP.

NX6110 and NX6220 Displays lack Ethernet hardware so do not support Modbus TCP and will require replacement (or use of Modbus RTU with control daughterboard).

It is important to note that the functionality provided is 'modbus TCP', not 'modbus RTU over TCP'

which is different.

This guide covers several different products; hence the parameters to be entered and connector terminal references may be different depending on the product used. Where such information is given, it will be given for both types of controllers in the following format of the following example:

…. option parameter 12.06000 / 13.06100 must be set to ….

where the required parameter may be 12.0 on a PPC6000, and 13.0 on an NX6100 controller.

1.2 Overview

NX6100/PPC6000 series controllers may be connected to a MODBUS communications system to enable data collection and limited control functions. The controllers are connected to the MODBUS via the Isolated RS485 Communications terminals on the controller, not the daughterboard. The MODBUS function requires a daughter board to be fitted to the controller.

The protocol supported is MODBUS RTU and the data configuration supported is 8-bits, no parity, 1-stop bit. This is the simplest and most common data configuration because the MODBUS protocol includes 'crc' to ensure data packet integrity.

NX6100/PPC6000 series controllers support 2-wire MODBUS, which in fact is often a 3-wire system where the 3rd wire is a 0V logic connection. This is the preferred wiring method. The MODBUS cable loops from one device to the other, a 'daisy chain' configuration as shown below.

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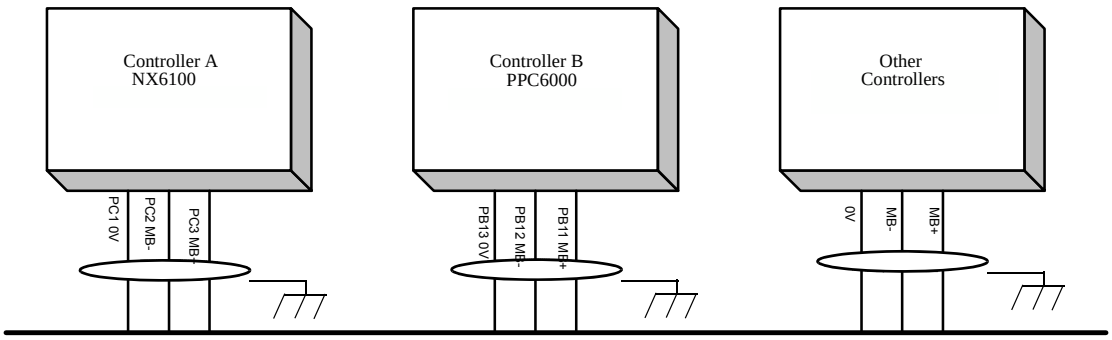


Figure 1: MODBUS Connections

Commands via MODBUS are only valid when the NX6100/PPC6000 series controller is in Normal/Remote operating mode as selected from the display. See the relevant NX6100 or PPC6000 bulletin for more information.

2. Wiring and Hardware Configuration

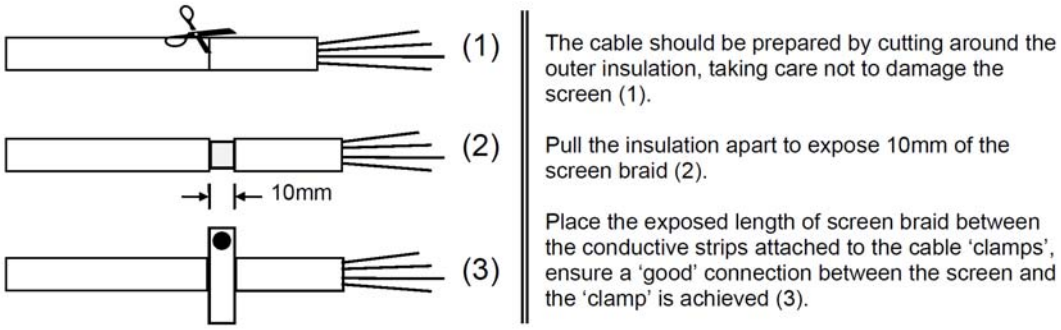
2.1 MODBUS cables

FIREYE recommends that RS485 MODBUS cables should be overall 'braid' screened, PVC insulated, 3-core of 24 AWG (7/0.2mm) wire minimum. This cable may be run adjacent to, and/or in the same conduit as high voltage wiring. Therefore, the cable voltage rating must exceed the maximum voltage carried by any other cable connected to the controller or run in the same conduit.

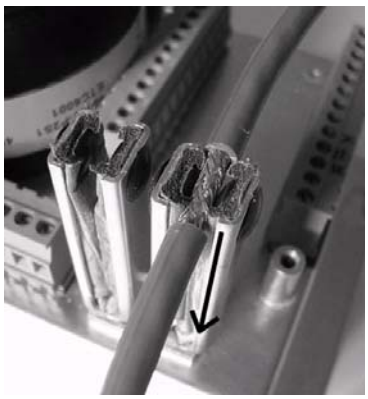
Terminate the screen **at each controller** using the cable clamps provided. **Incorrect connection or application of excess voltage may damage or destroy the controllers being connected.**

2.2 Screen termination

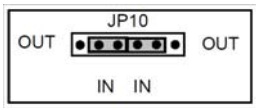
Screen termination clamps are provided on the main controller for termination of cable screens (tinned copper braid type). It is important to ensure that the screen and associated insulation cover the cable cores as close as possible to the terminals to which they are connected, and **not** cut-back to where the cable passes through the screen termination clamp.



NOTE: The 'clamps' are not intended to provide strain relief for the cables.



2.3 RS485 serial communications termination resistor



RS485 communication buses require balancing. This is achieved by applying termination resistors at the extremes of the cable. Ther re two resistors, one for each of the RS485 + and - wires. NX6100/PPC6000 series daughter boards have termination resistors on-board, which ae selected by JP1 jumpers on the daughter board.

If a FIREYE device is at the end of the bus then set both of the JP1 links to the IN position. All other controllers should have the links set to the OUT position. If only two controllers ar on the communications bus, set the termination resistors on both controllers to the IN position.

NOTE: The 'clamps' are not intended to provide strain relief for the cables.

3. Controller configuration.

3.1 Overview

Before configuring the NX6100/PPC6000 series controllers for MODBUS communications, the user must have a clear operating strategy defined. This strategy should define the operating speed of the bus, the bus addresses for each device on the bus and the data sets required of each bus device. Only when this information is clear should the system option parameters be set and the MODBUS system tested against the operating strategy.

3.2 Entering the Parameters

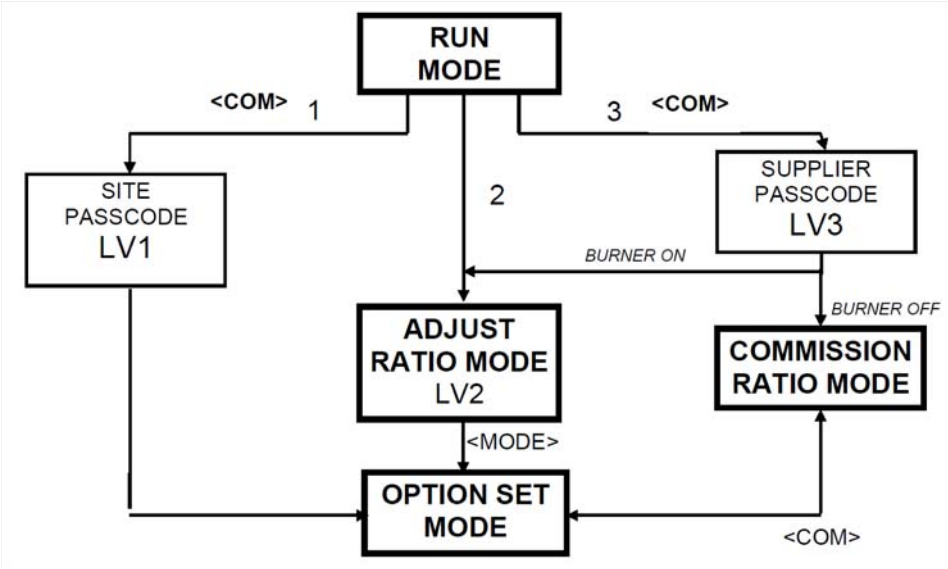
The NX6100/PPC6000 series controllers require configuration to match the MODBUS. Device address and communications speed are configured by setting option parameters in the controller. These parameters must be set for each and every NX6100/PPC6000 series controller on the MODBUS and are programmed when the controller is in Commissioning mode.

The controllers may be configured in any order but it is important to keep a record of the values programmed into each controller.

3.3 General

If any settings in the control are to be changed, it is necessary to enter a commission mode. Three passcodes are available for this purpose, shown as LV1 (Level 1), LV2 (Level 2), and LV3 (Level 3) in this manual

- Supplier passcode - LV3 - allows entry to all commissioning modes.
- Adjust ratio passcode - LV2 -- allows adjustment of some option parameters and entry to adjust ratio mode.
- Site passcode - LV1 -- allows adjustment of some option parameters.



3.3.1.1 Entering commission ratio mode

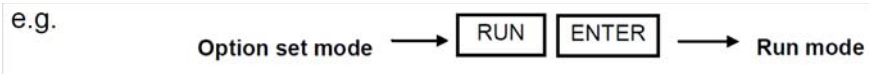
To enter commission mode, press the key labeled **COM** and select the site passcode value using the **UP/DOWN** keys. The site passcode has a factory default setting of 154. Enter this value as shown below.

*** - NOTE: If the site passcode has been changed, you will have to enter that number.**

3.3.1.2 Exiting from commission mode

To exit from any commission mode to run condition, press the key labeled RUN and then ENTER.

- Use the UP/DOWN keys to change the value of the option parameter. When the correct value is selected then press the ENTER key to store the new value.
- Set or adjust all of the parameters as required by moving between the parameters and adjusting as detailed above.



3.4 Option parameter list

> ***CAUTION***
>
> - Use extreme care when entering option parameters. Incorrect data entry could cause a hazardous situation to occur.
> - It is possible that additional parameters may be present in the unit depending on the application and/or supplier.

Note: Option parameters are marked with LV1, LV2, and LV3, which indicate what level passcode is required. If, when using the supplier passcode (LV3), it is not possible to adjust the value of an option parameter, then the burner must be turned off to make the adjustment.

Option 00.1 - Site passcode (0 - 999) LV3

This is a three digit passcode that will allow the site engineer or end-user to enter option set mode and adjust a limited range of option parameters (those not marked with 'LV2' or ' LV3' in this section). This passcode can be zero, in which case the user only needs to press the COM / ENTER key twice to enter option set mode with limited access. Factory default is 154.

Option 00.2 - Serial communications control address (0 - 15) LV1

If the control is to be connected to other equipment via the serial communications interface, it must be given a unique address using this option parameter. Additionally if more than one control unit is connected on the CAN bus (for example to share a display), the units must all have unique addresses BEFORE THEY ARE CONNECTED TO THE SAME CANbus. **This passcode is used with Comfire or sequencing and is not part of the MODBUS RTU setup.**

Option 00.7 - MODBUS device address (1 - 99) LV3

Default value is 0= OFF
This option sets the MODBUS device address for the controller and must be unique for each device on the bus.

Option 00.8 - MODBUS communications speed (0 - 3) LV3

Default value 0
This option sets the MODBUS communications speed in each controller as follows:

Option 00.8 value	Speed, bits/s
0	9600
1	4800
2	9600
3	19200

4. MODBUS RTU Data Sets

4.1 Overview.

The NX6100/PPC6000 series controllers support the following MODBUS register types :

- Coils (1 to 19) - These registers can be written to by a MODBUS master to provide control of NX6100/PPC6000 series controllers. In addition these registers can be read to interrogate the last value written.
- Input registers (1 to 1200, 16 bit) - These can be read by a MODBUS master to monitor combustion and other variables, from the NX6100/PPC6000 series controllers.
- Holding registers (1 to 1600, 16 bit) - These can be written to by a MODBUS master to change modulation control of NX6100/PPC6000 series controllers. As with Coils, these registers can be read to interrogate the last value written.

For daughterboard firmware levels 1.103 and greater, the MODBUS system can keep a maximum of 100 items (including read and written items) updated. Values will normally all refresh within one second, but if more than 50 items are being updated, this will extend to two seconds.

Only the last 100 registers requested from the MODBUS master will be remembered by the NX6100/PPC6000 controller. If more than 100 items are requested, the oldest items will cease to be active. This means that if more than 100 different items have been accessed since a particular item was read, this item may return zero the next time it is read, since the MODBUS system is no longer tracking that item. It will then become active and will hold valid data on the next read. In practice this is not an issue since there are nowhere near 100 items available from the NX6100/PPC6000 series controllers that will be of interest to plant operators etc. Most values that are available are 'engineers key' values that are provided for fault-finding and diagnostic purposes.

However, Coils and Holding registers are never 'dropped' from the item list in this way. So if the burner is turned off via MODBUS (for example), then 100 or more different read items are requested but the 'burner off' register is not updated, the burner will stay off.

The MODBUS 'read' functions listed in section 4.4 below allow multiple items to be read in one MODBUS request. However the maximum size of MODBUS messages is limited to 128 bytes. The maximum number of items that can be read in one message is 61, but it is recommended that significantly fewer registers are read. Again, this many contiguous registers will not all contain useful data anyway.

Note: Check daughterboard firmware level if Option 0.7 and 0.8 are correctly set and the MODBUS message structure has been verified as correct.

All address references in the MODBUS messages use numbers relative to zero. For example, the first holding register SETPOINT 1 CONTROL VALUE, would be 40001 and be referenced as register 0000. Similarly, coil 0008, BURNER ON/OFF, would be register 0007.

4.2 MODBUS system reset and timeout

It is possible to change operational parameters of the burner / boiler by writing to coils and holding registers (see following sections). Once one of these registers is written to, it will become 'active' and start to control the burner using the data written to it.

This register will remain 'active' controlling the burner forever unless there is no MODBUS communication to this slave for three minutes. So, if there are no MODBUS read requests or write requests for three minutes, all control functions will be disabled and the FIREYE controller will operate in it's default or local state.

As soon as communication resumes (even if just one register is read), the system will remember the active control register setting from before and those values previously written will be asserted once more.

Note : For daughterboard firmware levels less than 1.103, the timeout mechanism is slightly different - each MODBUS item had it's own 3 minute timeout and there isn't a 'global' MODBUS timeout. This means that all control registers have to be refreshed at least once every 3 minutes. Whilst this is good practice, it is no longer required for daughterboard firmware 1.103 onwards.

From version 1.103, it is possible to 'reset' the MODBUS system completely by writing a value of 1 to coil address 999. This will reset all coils and holding registers to the default (inactive) or local state. This will allow the burner to run from its local values in the event that some registers are holding it in an undesirable state. Note that there is a one minute timeout before the control 'forgets' the effects of the coils / holding registers and runs using it's default values.

4.3 Coils (0XXX(X)) - WRITE TO registers (MODBUS Function Code 5)

There are 20 coil registers available in the NX6100/PPC6000 series controllers. Coils are similar to switches in that they are set on or off. The MODBUS function code 15 (write multiple coils) is not supported.

The MODbus function code 15 (write multiple coils) is not supported.

Once a coil is written to, this value will be current until either
- the coil register is written to again with a different value, or
- there is no MODBUS activity to or from this slave for three minutes (MODBUS time-out), or
- the power is removed from the controller, or
- the MODBUS system is reset (see 'MODBUS reset').

For daughterboard firmware levels 1.103 and greater, the coil values may also be read using MODBUS function code 1. The value read back will be the last value that was written to that coil register. This function needs to be used with care because reading from a coil register that is currently inactive (i.e. never has been written to) will activate that coil with a default value of zero. So, if after a power-up the burner is running and then coil address 7 is read (never having been written to before) a value of zero will be returned and the burner will turn off. To turn the burner back on again, a value of 1 must be written to this coil (or the MODBUS system reset / power cycled).

Note: Not all items are valid for all models within the NX6100/PPC6000 series.

Table 1:

Reg Address	Function	Details
0	Setpoint Select	0 = Run to setpoint 1 1 = Run to setpoint 2 (use for night setback etc.)
1	Release to Ignite	If used, must be 1 to allow the burner to ignite.
2	Low Fire Hold	0= Normal modulation. 1= Low Fire Hold.
3	Lead boiler Select	Choose this to be the lead boiler if boiler sequencing is in operation.
4	Mute / Reset	Due to differing approvals requirements, this function may be disabled.
5	Oxygen Trim Enable	1 = Allow trim to be ON
6	Boiler Sequencing Enable	1 = Enable boiler sequencing (lead-lag). Must be done for every unit.
7	Burner ON/OFF	If the burner is firing / able to fire, it can be held OFF by writing a zero to this register.
8 – 10	Reserved for future use.	
11	Select Profile 1	1 = Force profile 1, 0 = Run with current profile.
12	Select Profile 2	1 = Force profile 2, 0 = Run with current profile.
13	Select Profile 3	1 = Force profile 3, 0 = Run with current profile.
14	Select Profile 4	1 = Force profile 4, 0 = Run with current profile.
15 – 998	Reserved for future use.	
999	Reset MODBUS	1 = Reset all coils and holding registers to the default (inactive) state. This will allow the burner to run from its local values.

4.4 Input Registers (3XXX(X)) - READ FROM (MODBUS function code 4)

There are many input registers available. The majority of these read current display or engineering (test) values from the system, but a subset of the fault log is also available if the control firmware is 1.201 or higher and the daughterboard firmware is 1.103 or higher.

For display and engineering values, these are all 16 bit registers holding signed integer numbers. When a number has decimal information, it is multiplied up to give an integer number.

For example:
173 ºC Flue Temperature will read as 173
3.2% oxygen will read as 32.
17.4º servo position will read as 174.
-12% trim will read as -12.
5.00 bar setpoint will read as 500.

Whilst the decimal precision is different for different items, it will not change for any particular item during normal use.

Each fault log item is an 8 byte structure stored in 4 consecutive 16 bit registers.

- Register 0 = (256 * fault number) + condition.
- Register 1 = (256 * year) + month
- Register 2 = (256 * day) + hour
- Register 3 = (256 * minute) + subset

Where :

- Condition = 0 for restart / reset, 1 = Cleared fault or limit (Cx), 2 = Fault (Fx) fault, 3 = Limit (Lx).
- Year is 00 to 99
- Month is 1 to 12
- Day is 1 to 31
- Hour = 0 to 23
- Minute is 0 to 59
- Subset is the fault subset information (0 to 255), if applicable.

Table 2:

Reg address	Function	Details
0	Drive 0 Position	As on product display.
1	Drive 1 Position	As on product display.
2	Drive 2 Position	As on product display.
3	Drive 3 Position	As on product display.
4	Drive 4 Position	As on product display.
5	Drive 5 Position	As on product display.
6	Drive 6 Position	As on product display.
7	Drive 7 Position	As on product display.
8	Drive 8 Position	As on product display.
9	Drive 9 Position	As on product display.
10	Spare	Do not use
11	Spare	Do not use
12	Measured Value	As on product display.
13	Efficiency	As on product display.
14	Inlet Temp	As on product display.
15	O2 Level	As on product display.
16	CO2 Level	As on product display.
17	Spare	
18	Hours Run	As on product display.
19	Burner Status	As on product display.
20	Trim	As on product display.
21	Setpoint	As on product display.
22	Flue Temp	As on product display.
23	Fault Number	As on product display.
24	Spare	
25	Spare	
26	Spare	
27	Profile Number	As on product display.
28	Do not use.	
29	Do not use.	
30	Modulation Rate	As on product display.
31	Spare	
32	Spare	
33	Spare	
34	Spare	

Reg address	Function	Details
35	Gas Pressure	As on product display.
36	Valve Prove Status	As on product display.
37	Flame Signal	As on product display.
38	2nd Flame Signal	UV level if IR is used
39 to 49	Reserved for future use	
1000	Engineers Key 0	Device specific data
1001	Engineers Key 1	Device specific data
1002	Engineers Key 2	Device specific data
1003 to 1199	Engineers Key 3 to 199	Device specific data
2000 to 2003	Fault log item 0	Most recently logged fault event
2004 to 2007	Fault log item 1	Next recently logged fault event
2008 to 2011	Fault log item 2	Next recently logged fault event
2012 to 2015	Fault log item 3	Next recently logged fault event
2016 to 2019	Fault log item 4	Next recently logged fault event
2020 to 2023	Fault log item 5	Next recently logged fault event
2024 to 2027	Fault log item 6	Next recently logged fault event
2028 to 2031	Fault log item 7	Next recently logged fault event
2032 to 2035	Fault log item 8	Next recently logged fault event
2036 to 2039	Fault log item 9	Next recently logged fault event
2040 to 2043	Fault log item 10	Next recently logged fault event
2044 to 2047	Fault log item 11	Next recently logged fault event
2048 to 2051	Fault log item 12	Next recently logged fault event
2052 to 2055	Fault log item 13	Next recently logged fault event
2056 to 2059	Fault log item 14	Next recently logged fault event
2060 to 2063	Fault log item 15	Next recently logged fault event
2064 to 2067	Fault log item 16	Next recently logged fault event
2068 to 2071	Fault log item 17	Next recently logged fault event
2072 to 2075	Fault log item 18	Next recently logged fault event
2076 to 2079	Fault log item 19	Next recently logged fault event
2080 to 2083	Fault log item 20	Next recently logged fault event
2084 to 2087	Fault log item 21	Next recently logged fault event
2088 to 2091	Fault log item 22	Next recently logged fault event
2092 to 2095	Fault log item 23	Oldest logged fault event

4.5 Holding Registers (4XXX(X)) - WRITE TO (MODBUS function code 6)

There are 20 holding (write to) registers available. These are 16 bit registers holding integer values. Writing an out of range value (for example 1000) will disable the control item and the system will go back to using its default value (immediately).

The MODBUS function code 16 (write multiple registers) is <u>not</u> supported.

Once a holding register is written to, this value will be current until either
- the holding register is written to again with a different value, or
- the holding register is written to again with an out of range value (>999), or
- there is no MODBUS activity to or from this slave for three minutes (MODBUS times out), or
- the power is removed from the controller, or
- the MODBUS system is reset (see 'MODBUS reset').

For daughterboard firmware levels 1.103 and greater, the holding register values may also be read using MODBUS function code 3. The value read back will be the last value that was written to that holding register. This function needs to be used with care because reading from a holding register that is currently inactive (i.e. has never been written to) will activate that holding with a default value of zero. So, for example, if after a power-up the burner is running with a default setpoint of 10.0 and then holding register address 0 is read (never having been written to before) a value of zero will be returned and the burners setpoint will become ZERO. To get the setpoint back to 10.0, a value of 100 (or >999) must be written to this register (or the MODBUS system reset / power cycled).

Table 3:

Reg. Address	Function	Details
0	Setpoint 1 Control Value	Strip decimal information – i.e. 999 = 99.9 = 9.99
1	Setpoint 2 Control Value	Strip decimal information – i.e. 999 = 99.9 = 9.99
2	Setpoint 1 Low Control Limit	Strip decimal information – i.e. 999 = 99.9 = 9.99
3	Setpoint 2 Low Control Limit	Strip decimal information – i.e. 999 = 99.9 = 9.99
4	Setpoint 1 High Control Limit	Strip decimal information – i.e. 999 = 99.9 = 9.99
5	Setpoint 2 High Control Limit	Strip decimal information – i.e. 999 = 99.9 = 9.99
6	Modulation Rate	0 = low fire, 999 = high fire
7 – 15	Reserved for future use.	

5. Modbus TCPIP Data Sets

5.1 Overview.

Only the register spaces for coils, input registers and holding registers are used by this system. Modbus defines each of these spaces as having 65536 possible 16 bit registers. These registers are numbered 1 to 65536 but are accessed in modbus messages by their addresses, which are always one less - so the addresses range from 0 to 65535. To attempt to avoid confusion, this document refers to both the number and address of each register.

Sometimes modbus register numbers are preceded by a number such as 0xxxx for coils, 4xxxx for holding registers and 3xxxx for input registers. This notation is not part of the modbus standard and is not used in this document as it fails to account for registers greater than 9999.

The modbus register map for modbus TCP is DIFFERENT to the register map used by 6000 series products with modbus RTU via RS485.

The following Modbus register types are supported :

- Coils (0 or 1) - These registers can be written to by a Modbus TCP master to provide control of certain ON/OFF functions such as turning the burner off, or selecting the night-setback setpoint. In addition these registers can be read to interrogate the last value written to them.
- Input registers (32 bit floating point, sent as two consecutive registers, low word first) - These can be read by a Modbus master to monitor combustion and other variables. Pairs of 16 bit modbus registers are used to give 32 bit floating-point registers. The value 1.205 (IEE754 = 3F9A3D71) would be sent as two holding registers, the first one containing 3D71 and the second one containing 3F9A.

Alternatively, the same data is available as 16 bit integers in the holding registers map, if required.

- Holding registers (16 bit integer) - Some of these registers provide access to the same read-only values as the input registers described above. Others can be written to by a Modbus master to change modulation control of the boiler. As with Coils, these registers can be read to interrogate the last value written. Decimal values are transferred 'multiplied up' as required to maintain precision so, 1.234, 12.34, 123.4 and 1234 are all sent as 1234.
- Read Discrete Inputs (Modbus Function code 2) - NXTSD104 and NX6330 ONLY These registers provide the status of the digital inputs, relay outputs and a few other status flage. Additionally, these registers can be used to read the status of the line voltage status inputs on the touch screen itself, if present. Note that the NX6110 and NX6220 displays do not support the use of these registers because it does not have the input hardware to which they relate.

The system will attempt to provide up-to-date data for all values read. However, values from the 'engineers key' lists can become out of date and if required should be requested frequently (or at least twice in succession with two or three seconds between) to ensure up-to-date data is returned. The expected scenario would be that the master would poll values once every 10 seconds or more frequently.

Values from the 'display values' list will always be up-to-date no matter how infrequently they are read.

Control functions initiated by writing to coils and holding registers are remembered permanently while modbus TCP communications are active (values being read or written). If there is no modbus TCP activity for one minute, the control functions will time-out and the system will revert to default automatic operation. If subsequently modbus TCP communications resume, the control functions previously set will resume also.

Note : NXTSD104 Displays prior to version 2.205 were subject to a one minute timeout per function meaning each control function required frequent refresh to remain operative. This behaviour has now been changed.

5.2 Coils (READ / WRITE) registers (Modbus Function Codes 1 & 5)

Sometimes these registers are referred to as registers 0xxxx registers although this notation is not part of the modbus standard and is not used here.

There are 16 coil registers available for a single burner system. Coils are similar to switches in that they are set on or off. The modbus function code 15 (write multiple coils) is NOT supported however the coil values may also be read using modbus function code 1. The value read back will be the last value that was written to that coil register. These registers must be used with care since they can prevent the boiler from operating or meeting the site load.

If used, these registers must be written to at least as often as once a minute. After one minute, the function will timeout and the control will revert to it's default mode of operation.

When an NXTSD104 touch screen is being used in a 'twin firing' configuration, these items relate to the left-hand-side (LHS) burner. The list of functions for the right-hand-side (RHS) burner can be found by adding 10000 to the register address. The NX6110 display does not currently support twin firing configurations.

When the display is being used with a water-level control / expansion unit, modbus functions relating to that unit can be accessed by adding 20000 to the register address. However, no coil functions are currently supported by these units.

Note : Not all items are valid for all models within the Fireye 6000 series.

Table 4:

Register number	*Register address*	*Function*	*Details*
1	0	Setpoint Select	0 = Run to setpoint 1. 1 = Run to setpoint 2 (use for night setback etc.). This register MUST NOT be written to if the built-in boiler
2	1	Release to	If used, must be 1 to allow the burner to ignite.
3	2	Low Fire	0= Normal modulation.
4	3	Lead boiler	Choose this to be the lead boiler if boiler sequencing is in operation.
5	4	Mute / Reset	Due to differing approvals requirements, this function may be disabled. This register will mute the alarms and reset the fault, allowing the burner to restart. To do this, the register must be set to 1 for typically 5 seconds. Once the fault has been reset, or after 5 seconds, the register should be cleared. DO NOT ACTIVATE THIS REGISTER WHEN THERE ARE NO ALARMS TO MUTE. If this is repeatedly done, an F36 fault will
6	5	Oxygen	1 = Allow trim to be
7	6	Boiler Sequencing	1 = Enable boiler sequencing (lead-lag). Must be done for every unit.
8	7	Burner	If the burner is firing / able to fire, it can be held OFF by writing a zero to
9	8	Fault Mute Only	When set to 1, this register will mute fault alarms. Unlike register number 5 (address 4), this register will not cause the burner to restart if the fault has cleared, no matter how long it is left on for. As with the other register, it should be set to 0 after use. **Compatibility note :** This function requires controls with firmware versions 1.221 or
10 - 11	9 – 10	Reserv	
12	11	Select	1 = Force profile 1, 0 = Run with current profile. Integrated controls
13	12	Select	1 = Force profile 2, 0 = Run with current profile. Integrated controls
14	13	Select	1 = Force profile 3, 0 = Run with current profile. Integrated controls
15	14	Select	1 = Force profile 4, 0 = Run with current profile. Integrated controls
16 onwards	15 onwards	Reserved for future use	

5.3 Input (READ ONLY) registers (Modbus function code 4)

Sometimes these registers are referred to as registers 3xxxx registers although this notation is not part of the modbus standard and is not used here.

There are many input registers available, these read current display or engineering (test) values from the system.

These values are sent as 32 bit IEE754 floating point values, sent as two consecutive registers - low word first.

This example illustrates reading the burner control firmware version via EK56 (EK stands for engineers key). From the table opposite, EK56 starts at register 314 (address 313). A modbus poll for two registers 314 & 315 (addresses 313 & 314) yields :
Address 313 = 0x3D71
Address 314 = 0x3F9A.

The value 1.205 (IEE754 = 3F9A3D71) has been sent as two holding registers, the first one containing 3D71 and the second one containing 3F9A.

Alternatively, the same data is available as 16 bit integers in the holding registers map, if the modbus master is easier configured to use standard modbus integer registers.

When the touch screen is being used in a 'twin firing' configuration, these items relate to the left-hand-side (LHS) burner. The list of functions for the right-hand-side (RHS) burner can be found by adding 10000 to the register number / address.

When the display is being used with a water-level control / expansion unit, modbus functions relating to that unit can be accessed by adding 20000 to the register address. In this case, see Table 6 on page 24 below

Table 5: .

Burner Controls			
Register Number	***Register address***	***Function***	***Details***
1	0	Drive 0 Position	As on product display.
3	2	Drive 1 Position	As on product display.
5	4	Drive 2 Position	As on product display.
7	6	Drive 3 Position	As on product display.
9	8	Drive 4 Position	As on product display.
11	10	Drive 5 Position	As on product display.
13	12	Drive 6 Position	As on product display.
15	14	Drive 7 Position	As on product display.
17	16	Drive 8 Position	As on product display.
19	18	Drive 9 Position	As on product display.
21	20	Spare	Do not use
23	22	Spare	Do not use
25	24	Measured Value	As on product display.
27	26	Efficiency	As on product display.
29	28	Inlet Temp	As on product display.
31	30	O2 Level	As on product display.
33	32	CO2 Level	As on product display.
35	34	Spare	
37	36	Hours Run	As on product display.
39	38	Burner Status	As on product display.
41	40	Trim	As on product display.
43	42	Setpoint	As on product display.
45	44	Flue Temp	As on product display.
47	46	Fault Number	As on product display.
49	48	Spare	
51	50	Spare	
53	52	Spare	

Burner Controls			
Register Number	**Register address**	**Function**	**Details**
55	54	Profile Number	As on product display.
57	56	Do not use.	
59	58	Do not use.	
61	60	Modulation Rate	As on product display.
63	62	Spare	
65	64	Spare	
67	66	Spare	
69	68	Spare	
71	70	Gas Pressure	As on product display.
73	72	Valve Prove Status	As on product display.
75	74	Flame Signal	As on product display.
77	76	2nd Flame Signal	UV level if IR is used
79 – 198	78 - 197	Reserved for future use	
199	198	Touchscreen firmware version	The firmware version of the touchscreen providing modbus TCP.
		Reserved for future use	
201	200	Engineers Key 0	See product manual 'EK' list
203	202	Engineers Key 1	See product manual 'EK' list
205	204	Engineers Key 2	See product manual 'EK' list
207	206	Engineers Key 3	See product manual 'EK' list
209	208	Engineers Key 4	See product manual 'EK' list
211	210	Engineers Key 5	See product manual 'EK' list
213	212	Engineers Key 6	See product manual 'EK' list
215	214	Engineers Key 7	See product manual 'EK' list
217	216	Engineers Key 8	See product manual 'EK' list
219	218	Engineers Key 9	See product manual 'EK' list
221	220	Engineers Key 10	See product manual 'EK' list
223	222	Engineers Key 11	See product manual 'EK' list
225	224	Engineers Key 12	See product manual 'EK' list
227	226	Engineers Key 13	See product manual 'EK' list
229	228	Engineers Key 14	See product manual 'EK' list
231	230	Engineers Key 15	See product manual 'EK' list
233	232	Engineers Key 16	See product manual 'EK' list
235	234	Engineers Key 17	See product manual 'EK' list
237	236	Engineers Key 18	See product manual 'EK' list
239	238	Engineers Key 19	See product manual 'EK' list
241	240	Engineers Key 20	See product manual 'EK' list
243	242	Engineers Key 21	See product manual 'EK' list
245	244	Engineers Key 22	See product manual 'EK' list
247	246	Engineers Key 23	See product manual 'EK' list
249	248	Engineers Key 24	See product manual 'EK' list
251	250	Engineers Key 25	See product manual 'EK' list
253	252	Engineers Key 26	See product manual 'EK' list
255	254	Engineers Key 27	See product manual 'EK' list
257	256	Engineers Key 28	See product manual 'EK' list
259	258	Engineers Key 29	See product manual 'EK' list
261	260	Engineers Key 30	See product manual 'EK' list
263	262	Engineers Key 31	See product manual 'EK' list
265	264	Engineers Key 32	See product manual 'EK' list
267	266	Engineers Key 33	See product manual 'EK' list
269	268	Engineers Key 34	See product manual 'EK' list
271	270	Engineers Key 35	See product manual 'EK' list
273	272	Engineers Key 36	See product manual 'EK' list
275	274	Engineers Key 37	See product manual 'EK' list
277	276	Engineers Key 38	See product manual 'EK' list

Burner Controls			
Register Number	**Register address**	**Function**	**Details**
279	278	Engineers Key 39	See product manual ‘EK’ list
281	280	Engineers Key 40	See product manual ‘EK’ list
283	282	Engineers Key 41	See product manual ‘EK’ list
285	284	Engineers Key 42	See product manual ‘EK’ list
287	286	Engineers Key 43	See product manual ‘EK’ list
289	288	Engineers Key 44	See product manual ‘EK’ list
291	290	Engineers Key 45	See product manual ‘EK’ list
293	292	Engineers Key 46	See product manual ‘EK’ list
295	294	Engineers Key 47	See product manual ‘EK’ list
297	296	Engineers Key 48	See product manual ‘EK’ list
299	298	Engineers Key 49	See product manual ‘EK’ list
301	300	Engineers Key 50	See product manual ‘EK’ list
303	302	Engineers Key 51	See product manual ‘EK’ list
305	304	Engineers Key 52	See product manual ‘EK’ list
307	306	Engineers Key 53	See product manual ‘EK’ list
309	308	Engineers Key 54	See product manual ‘EK’ list
311	310	Engineers Key 55	See product manual ‘EK’ list
313	312	Engineers Key 56	See product manual ‘EK’ list
315	314	Engineers Key 57	See product manual ‘EK’ list
317	316	Engineers Key 58	See product manual ‘EK’ list
319	318	Engineers Key 59	See product manual ‘EK’ list
321	320	Engineers Key 60	See product manual ‘EK’ list
323	322	Engineers Key 61	See product manual ‘EK’ list
325	324	Engineers Key 62	See product manual ‘EK’ list
327	326	Engineers Key 63	See product manual ‘EK’ list
329	328	Engineers Key 64	See product manual ‘EK’ list
331	330	Engineers Key 65	See product manual ‘EK’ list
333	332	Engineers Key 66	See product manual ‘EK’ list
335	334	Engineers Key 67	See product manual ‘EK’ list
337	336	Engineers Key 68	See product manual ‘EK’ list
339	338	Engineers Key 69	See product manual ‘EK’ list
341	340	Engineers Key 70	See product manual ‘EK’ list
343	342	Engineers Key 71	See product manual ‘EK’ list
345	344	Engineers Key 72	See product manual ‘EK’ list
347	346	Engineers Key 73	See product manual ‘EK’ list
349	348	Engineers Key 74	See product manual ‘EK’ list
351	350	Engineers Key 75	See product manual ‘EK’ list
353	352	Engineers Key 76	See product manual ‘EK’ list
355	354	Engineers Key 77	See product manual ‘EK’ list
357	356	Engineers Key 78	See product manual ‘EK’ list
359	358	Engineers Key 79	See product manual ‘EK’ list
361	360	Engineers Key 80	See product manual ‘EK’ list
363	362	Engineers Key 81	See product manual ‘EK’ list
365	364	Engineers Key 82	See product manual ‘EK’ list
367	366	Engineers Key 83	See product manual ‘EK’ list
369	368	Engineers Key 84	See product manual ‘EK’ list
371	370	Engineers Key 85	See product manual ‘EK’ list
373	372	Engineers Key 86	See product manual ‘EK’ list
375	374	Engineers Key 87	See product manual ‘EK’ list
377	326	Engineers Key 88	See product manual ‘EK’ list
379	328	Engineers Key 89	See product manual ‘EK’ list
381	380	Engineers Key 90	See product manual ‘EK’ list
383	382	Engineers Key 91	See product manual ‘EK’ list
385	384	Engineers Key 92	See product manual ‘EK’ list
387	386	Engineers Key 93	See product manual ‘EK’ list

Burner Controls			
Register Number	**Register address**	**Function**	**Details**
389	388	Engineers Key 94	See product manual ‘EK’ list
391	390	Engineers Key 95	See product manual ‘EK’ list
393	392	Engineers Key 96	See product manual ‘EK’ list
395	394	Engineers Key 97	See product manual ‘EK’ list
397	396	Engineers Key 98	See product manual ‘EK’ list
399	398	Engineers Key 99	See product manual ‘EK’ list
401	400	Engineers Key 100	See product manual ‘EK’ list
403	402	Engineers Key 101	See product manual ‘EK’ list
405	404	Engineers Key 102	See product manual ‘EK’ list
407	406	Engineers Key 103	See product manual ‘EK’ list
409	408	Engineers Key 104	See product manual ‘EK’ list
411	410	Engineers Key 105	See product manual ‘EK’ list
413	412	Engineers Key 106	See product manual ‘EK’ list
415	414	Engineers Key 107	See product manual ‘EK’ list
417	416	Engineers Key 108	See product manual ‘EK’ list
419	418	Engineers Key 109	See product manual ‘EK’ list
421	420	Engineers Key 110	See product manual ‘EK’ list
423	422	Engineers Key 111	See product manual ‘EK’ list
425	424	Engineers Key 112	See product manual ‘EK’ list
427	426	Engineers Key 113	See product manual ‘EK’ list
429	428	Engineers Key 114	See product manual ‘EK’ list
431	430	Engineers Key 115	See product manual ‘EK’ list
433	432	Engineers Key 116	See product manual ‘EK’ list
435	434	Engineers Key 117	See product manual ‘EK’ list
437	436	Engineers Key 118	See product manual ‘EK’ list
439	438	Engineers Key 119	See product manual ‘EK’ list
441	440	Engineers Key 120	See product manual ‘EK’ list
443	442	Engineers Key 121	See product manual ‘EK’ list
445	444	Engineers Key 122	See product manual ‘EK’ list
447	446	Engineers Key 123	See product manual ‘EK’ list
449	448	Engineers Key 124	See product manual ‘EK’ list
451	450	Engineers Key 125	See product manual ‘EK’ list
453	452	Engineers Key 126	See product manual ‘EK’ list
455	454	Engineers Key 127	See product manual ‘EK’ list
457	456	Engineers Key 128	See product manual ‘EK’ list
459	458	Engineers Key 129	See product manual ‘EK’ list
461	460	Engineers Key 130	See product manual ‘EK’ list
463	462	Engineers Key 131	See product manual ‘EK’ list
465	464	Engineers Key 132	See product manual ‘EK’ list
467	466	Engineers Key 133	See product manual ‘EK’ list
469	468	Engineers Key 134	See product manual ‘EK’ list
471	470	Engineers Key 135	See product manual ‘EK’ list
473	472	Engineers Key 136	See product manual ‘EK’ list
475	474	Engineers Key 137	See product manual ‘EK’ list
477	476	Engineers Key 138	See product manual ‘EK’ list
479	478	Engineers Key 139	See product manual ‘EK’ list
481	480	Engineers Key 140	See product manual ‘EK’ list
483	482	Engineers Key 141	See product manual ‘EK’ list
485	484	Engineers Key 142	See product manual ‘EK’ list
487	486	Engineers Key 143	See product manual ‘EK’ list
489	488	Engineers Key 144	See product manual ‘EK’ list
491	490	Engineers Key 145	See product manual ‘EK’ list
493	492	Engineers Key 146	See product manual ‘EK’ list
495	494	Engineers Key 147	See product manual ‘EK’ list
497	496	Engineers Key 148	See product manual ‘EK’ list

Burner Controls			
Register Number	**Register address**	**Function**	**Details**
499	498	Engineers Key 149	See product manual ‘EK’ list
501	500	Engineers Key 150	See product manual ‘EK’ list
503	502	Engineers Key 151	See product manual ‘EK’ list
505	504	Engineers Key 152	See product manual ‘EK’ list
507	506	Engineers Key 153	See product manual ‘EK’ list
509	508	Engineers Key 154	See product manual ‘EK’ list
511	510	Engineers Key 155	See product manual ‘EK’ list
513	512	Engineers Key 156	See product manual ‘EK’ list
515	514	Engineers Key 157	See product manual ‘EK’ list
517	516	Engineers Key 158	See product manual ‘EK’ list
519	518	Engineers Key 159	See product manual ‘EK’ list
521	520	Engineers Key 160	See product manual ‘EK’ list
523	522	Engineers Key 161	See product manual ‘EK’ list
525	524	Engineers Key 162	See product manual ‘EK’ list
527	526	Engineers Key 163	See product manual ‘EK’ list
529	528	Engineers Key 164	See product manual ‘EK’ list
531	530	Engineers Key 165	See product manual ‘EK’ list
533	532	Engineers Key 166	See product manual ‘EK’ list
535	534	Engineers Key 167	See product manual ‘EK’ list
537	536	Engineers Key 168	See product manual ‘EK’ list
539	538	Engineers Key 169	See product manual ‘EK’ list
541	540	Engineers Key 170	See product manual ‘EK’ list
343	542	Engineers Key 171	See product manual ‘EK’ list
545	544	Engineers Key 172	See product manual ‘EK’ list
547	546	Engineers Key 173	See product manual ‘EK’ list
549	548	Engineers Key 174	See product manual ‘EK’ list
551	550	Engineers Key 175	See product manual ‘EK’ list
553	552	Engineers Key 176	See product manual ‘EK’ list
555	554	Engineers Key 177	See product manual ‘EK’ list
557	556	Engineers Key 178	See product manual ‘EK’ list
559	558	Engineers Key 179	See product manual ‘EK’ list
561	560	Engineers Key 180	See product manual ‘EK’ list
563	562	Engineers Key 181	See product manual ‘EK’ list
565	564	Engineers Key 182	See product manual ‘EK’ list
567	566	Engineers Key 183	See product manual ‘EK’ list
569	568	Engineers Key 184	See product manual ‘EK’ list
571	570	Engineers Key 185	See product manual ‘EK’ list
573	572	Engineers Key 186	See product manual ‘EK’ list
575	574	Engineers Key 187	See product manual ‘EK’ list
577	526	Engineers Key 188	See product manual ‘EK’ list
579	528	Engineers Key 189	See product manual ‘EK’ list
581	580	Engineers Key 190	See product manual ‘EK’ list
583	582	Engineers Key 191	See product manual ‘EK’ list
585	584	Engineers Key 192	See product manual ‘EK’ list
587	586	Engineers Key 193	See product manual ‘EK’ list
589	588	Engineers Key 194	See product manual ‘EK’ list
591	590	Engineers Key 195	See product manual ‘EK’ list
593	592	Engineers Key 196	See product manual ‘EK’ list
595	594	Engineers Key 197	See product manual ‘EK’ list
597	596	Engineers Key 198	See product manual ‘EK’ list
599	598	Engineers Key 199	See product manual ‘EK’ list
601	600	Engineers Key 200	See product manual ‘EK’ list

Table 6: **Water Level Control**

Input Registers		*Water Level Controls*	
Register Number	**Register Address**	**Function**	**Details**
20025	20024	Measured water level	As on product display.
20039	20038	Controller status	0 = Fault, 1 = Working
20043	20042	Water level setpoint	Available on controller firmware 1.117 and later.
20061	20060	Valve / pump output	10 = 1.0% (minimum) 999 = 99.9% maximum.
20101	20100	Measured water level	As register address 20012
20103	20102	TDS level	OPTIONAL. Total dissolved solids in units as calibrated (ppm, uS…)
20105	20104	Feed-water flow rate	
20107	20106	Feed-water temperature	
20109	20108	Steam flow rate	
20111	20110	Steam temperature	OPTIONAL.
20113	20112	Economiser water inlet temperature	OPTIONAL.
20115	20114	Economiser flue out temperature	OPTIONAL.
20117	20116	Economiser heat recovered kW	OPTIONAL.
20119	20118	Economiser heat recovered %	OPTIONAL.
20201	20200	Engineers Key 0	Reserved
20203	20202	Engineers Key 1	Low Voltage Digital Input 1 WB9 – WB10
20205	20204	Engineers Key 2	Low Voltage Digital Input 2 WB9 – WB11
20207	20206	Engineers Key 3	Low Voltage Digital Input 3 WB9 – WB12
20209	20208	Engineers Key 4	Low Voltage Digital Input 4 WB9 – WB13
20211	20210	Engineers Key 5	Low Voltage Digital Input 5 WB14 – WB15
20213	20212	Engineers Key 6	Low Voltage Digital Input 6 WB14 – WB16
20215	20214	Engineers Key 7	Low Voltage Digital Input 7 WB14 – WB17
20217	20216	Engineers Key 8	Low Voltage Digital Input 8 WB5 – WB6
20219	20218	Engineers Key 9	Reserved
20221	20220	Engineers Key 10	Reserved
20223	20222	Engineers Key 11	Reserved
20225	20224	Engineers Key 12	High voltage digital input 12. WE4
20227	20226	Engineers Key 13	High voltage digital input 13. WE5
20229	20228	Engineers Key 14	Burner Select Input (High Voltage) WE6
20231	20230	Engineers Key 15	Reserved
20233	20232	Engineers Key 16	Reserved
20235	20234	Engineers Key 17	Reserved
20237	20236	Engineers Key 18	Reserved
20239	20238	Engineers Key 19	Reserved
20241	20240	Engineers Key 20	Reserved

Input Registers		*Water Level Controls*	
Register Number	**Register Address**	**Function**	**Details**
20243	20242	Engineers Key 21	Reserved
20245	20244	Engineers Key 22	Reserved
20247	20246	Engineers Key 23	Draft Open mode
20249	20248	Engineers Key 24	Reserved
20251	20250	Engineers Key 25	Reserved
20253	20252	Engineers Key 26	Reserved
20255	20254	Engineers Key 27	Reserved
20257	20256	Engineers Key 28	Reserved
20259	20258	Engineers Key 29	Reserved
20261	20260	Engineers Key 30	Reserved
20263	20262	Engineers Key 31	Reserved
20265	20264	Engineers Key 32	Reserved
20267	20266	Engineers Key 33	Reserved
20269	20268	Engineers Key 34	Reserved
20271	20270	Engineers Key 35	Reserved
20273	20272	Engineers Key 36	Reserved
20275	20274	Engineers Key 37	Reserved
20277	20276	Engineers Key 38	Reserved
20279	20278	Engineers Key 39	Reserved
20281	20280	Engineers Key 40	Reserved
20283	20282	Engineers Key 41	Reserved
20285	20284	Engineers Key 42	Reserved
20287	20286	Engineers Key 43	Reserved
20289	20288	Engineers Key 44	Reserved
20291	20290	Engineers Key 45	Reserved
20293	20292	Engineers Key 46	Reserved
20295	20294	Engineers Key 47	Reserved
20297	20296	Engineers Key 48	Reserved
20299	20298	Engineers Key 49	Reserved
20301	20300	Engineers Key 50	Reserved
20303	20302	Engineers Key 51	Reserved
20305	20304	Engineers Key 52	Reserved
20307	20306	Engineers Key 53	Reserved
20309	20308	Engineers Key 54	Reserved
20311	20310	Engineers Key 55	Main PCB issue
20313	20312	Engineers Key 56	Firmware issue.

Input Registers		*Water Level Controls*	
Register Number	**Register Address**	**Function**	**Details**
20315	20314	Engineers Key 57	Spare
20317	20316	Engineers Key 58	CPU serial number (low 4 digits)
20319	20318	Engineers Key 59	Reserved
20321	20320	Engineers Key 60	Reserved
20323	20322	Engineers Key 61	Analog Input 1. Expansion unit Terminal WA7.
20325	20324	Engineers Key 62	Analog Input 2. Expansion unit Terminal WA8.
20327	20326	Engineers Key 63	Analog Input 3. Expansion unit Terminal WA9.
20329	20328	Engineers Key 64	Analog Input 4. Expansion unit Terminal WA12
20331	20330	Engineers Key 65	Analog Input 5. Expansion unit Terminal WA15
20333	20332	Engineers Key 66	Analog Input 6. Expansion unit Terminal WA19
20335	20334	Engineers Key 67	Reserved
20337	20336	Engineers Key 68	Reserved
20339	20338	Engineers Key 69	Internal 24V low test
20341	20340	Engineers Key 70	Internal 24V high test
20343	20342	Engineers Key 71	NXDBWLC Daughter-board status
20345	20344	Engineers Key 72	PT100 temperature reading
20347	20346	Engineers Key 73	Reserved
20349	20348	Engineers Key 74	CPU utilisation (%).
20351	20350	Engineers Key 75	Reserved
20353	20352	Engineers Key 76	Reserved
20355	20354	Engineers Key 77	Program size.
20357	20356	Engineers Key 78	Reserved
20359	20358	Engineers Key 79	Reserved
20361	20360	Engineers Key 80	Drive Error values for drives 0 to 9.
20363	20362	Engineers Key 81	Drive Error values for drives 0 to 9.
20365	20364	Engineers Key 82	Drive Error values for drives 0 to 9.
20367	20366	Engineers Key 83	Drive Error values for drives 0 to 9.
20369	20368	Engineers Key 84	Drive Error values for drives 0 to 9.
20371	20370	Engineers Key 85	Drive Error values for drives 0 to 9.
20373	20372	Engineers Key 86	Drive Error values for drives 0 to 9.
20375	20374	Engineers Key 87	Drive Error values for drives 0 to 9.
20377	20326	Engineers Key 88	Drive Error values for drives 0 to 9.
20379	20328	Engineers Key 89	Drive Error values for drives 0 to 9.

Input Registers		*Water Level Controls*	
Register Number	**Register Address**	**Function**	**Details**
32081	20380	Engineers Key 90	Spare
20383	20382	Engineers Key 91	Spare
20385	20384	Engineers Key 92	Spare
20387	20386	Engineers Key 93	Spare
20389	20388	Engineers Key 94	Spare
20391	20390	Engineers Key 95	Spare
20393	20392	Engineers Key 96	Spare
20395	20394	Engineers Key 97	Spare
20397	20396	Engineers Key 98	Spare
20399	20398	Engineers Key 99	Spare
20401	20400	Engineers Key 100	Firmware type PT22xxxx
20403	20402	Engineers Key 101	Feed Water ON/OFF mode active
20405	20404	Engineers Key 102	Pump ON Input Active
20407	20406	Engineers Key 103	Pump OFF Input Active
20409	20408	Engineers Key 104	2nd Element (steam) Active
20411	20410	Engineers Key 105	3rd Element (feed flow) Active
20413	20412	Engineers Key 106	Reserved
20415	20414	Engineers Key 107	Reserved
20417	20416	Engineers Key 108	Reserved
20419	20418	Engineers Key 109	Reserved
20421	20420	Engineers Key 110	Reserved
20423	20422	Engineers Key 111	Reserved
20425	20424	Engineers Key 112	Reserved
20427	20426	Engineers Key 113	Reserved
20429	20428	Engineers Key 114	Reserved
20431	20430	Engineers Key 115	Reserved
20433	20432	Engineers Key 116	Reserved
20435	20434	Engineers Key 117	Reserved
20437	20436	Engineers Key 118	Reserved
20439	20438	Engineers Key 119	Reserved
20441	20440	Engineers Key 120	Draft Wait Damper
20443	20442	Engineers Key 121	Low Draft Pressure reached
20445	20444	Engineers Key 122	High Draft Pressure reached
20447	20446	Engineers Key 123	Draft Panel Switch OFF
20449	20448	Engineers Key 124	Reserved
20451	20450	Engineers Key 125	Reserved
20453	20452	Engineers Key 126	Reserved
20455	20454	Engineers Key 127	Reserved

Input Registers		*Water Level Controls*	
Register Number	**Register Address**	**Function**	**Details**
20457	20456	Engineers Key 128	Reserved
20459	20458	Engineers Key 129	Reserved
20461	20460	Engineers Key 130	Reserved
20463	20462	Engineers Key 131	Reserved
20465	20464	Engineers Key 132	Reserved
20467	20466	Engineers Key 133	Reserved
20469	20468	Engineers Key 134	Reserved
20471	20470	Engineers Key 135	Reserved
20473	20472	Engineers Key 136	Reserved
20475	20474	Engineers Key 137	Reserved
20477	20476	Engineers Key 138	Reserved
20479	20478	Engineers Key 139	Reserved
20481	20480	Engineers Key 140	Reserved
20483	20482	Engineers Key 141	Reserved
20485	20484	Engineers Key 142	Reserved
20487	20486	Engineers Key 143	Reserved
20489	20488	Engineers Key 144	Reserved
20491	20490	Engineers Key 145	Reserved
20493	20492	Engineers Key 146	Reserved
20495	20494	Engineers Key 147	Reserved
20497	20496	Engineers Key 148	Reserved
20499	20498	Engineers Key 149	Reserved
20501	20500	Engineers Key 150	Reserved
20503	20502	Engineers Key 151	Pump Cut-out (ON/OFF control only)
20505	20504	Engineers Key 152	Pump Cut-in (ON/OFF control only)
20507	20506	Engineers Key 153	Reserved
20509	20508	Engineers Key 154	Steam Flow
20511	20510	Engineers Key 155	1st Element (level) output
20513	20512	Engineers Key 156	1st and 2nd Element output
20515	20514	Engineers Key 157	Feedwater Flow SP (3 element)
20517	20516	Engineers Key 158	Reserved
20519	20518	Engineers Key 159	2nd Element (steam) output
20521	20520	Engineers Key 160	Level Output (raw)
20523	20522	Engineers Key 161	Level Output (linearized)
20525	20524	Engineers Key 162	Reserved
20527	20526	Engineers Key 163	Reserved
20529	20528	Engineers Key 164	Reserved
20531	20530	Engineers Key 165	Reserved
20533	20532	Engineers Key 166	Reserved
20535	20534	Engineers Key 167	Reserved
20537	20536	Engineers Key 168	Reserved

Input Registers		*Water Level Controls*	
Register Number	**Register Address**	**Function**	**Details**
20539	20538	Engineers Key 169	Reserved
20541	20540	Engineers Key 170	Draft Pressure
20343	20542	Engineers Key 171	Draft Output
20545	20544	Engineers Key 172	Draft Setpoint
20547	20546	Engineers Key 173	Reserved
20549	20548	Engineers Key 174	Reserved
20551	20550	Engineers Key 175	Reserved
20553	20552	Engineers Key 176	Reserved
20555	20554	Engineers Key 177	Reserved
20557	20556	Engineers Key 178	Reserved
20559	20558	Engineers Key 179	Reserved
20561	20560	Engineers Key 180	Reserved
20563	20562	Engineers Key 181	Reserved
20565	20564	Engineers Key 182	Reserved
20567	20566	Engineers Key 183	Reserved
20569	20568	Engineers Key 184	Reserved
20571	20570	Engineers Key 185	Reserved
20573	20572	Engineers Key 186	Reserved
20575	20574	Engineers Key 187	Reserved
20577	20526	Engineers Key 188	Reserved
20579	20528	Engineers Key 189	Reserved
20581	20580	Engineers Key 190	Reserved
20583	20582	Engineers Key 191	Reserved
20585	20584	Engineers Key 192	Reserved
20587	20586	Engineers Key 193	Reserved
20589	20588	Engineers Key 194	Reserved
20591	20590	Engineers Key 195	Reserved
20593	20592	Engineers Key 196	Reserved
20595	20594	Engineers Key 197	Reserved
20597	20596	Engineers Key 198	Reserved
20599	20598	Engineers Key 199	Reserved
20601	20600	Engineers Key 200	WLC Control Program revision

Note: See bulletin NXEXP-6001 for extended descriptions for the table above

5.4 Holding (READ FROM / WRITE TO) registers (Modbus function codes 3 & 6)

Sometimes these registers are referred to as registers 4xxxx registers although this notation is not part of the modbus standard and is not used here.

There are many holding registers available :

- The display values 0 to 40 as in the input registers above but as 16 bit integers (READ ONLY)
- The engineers values (EK's) 0 to 200 as in the input registers above but as 16 bit integers (READ ONLY)
- The remote control holding registers that can be written to (READ / WRITE).
- A copy of the holding registers from a fireye burner control if used.

The 16 writable holding registers are register numbers 801 to 816 (address 800 to 815). These are 16 bit registers holding integer values which normally range from 0 to 999. Writing an out of range value (for example 1000) will disable the control item and the system will go back to using its default value (immediately).

The modbus function code 16 (write multiple registers) is **not** supported. The writable registers must be used with care because the parameters available can stop the boiler from operating as required to meet the site load.

If used, these registers must be written to at least as often as once a minute. After one minute, the function will timeout and the control will revert to it's default mode of operation.

For display, engineers (EK) values and remote control values, these are all 16 bit registers holding signed integer numbers. When a number has decimal information, it is multiplied up to give an integer number. For example:

173 ºC Flue Temperature will read as 173
3.2% oxygen will read as 32.
17.4º servo position will read as 174.
-12% trim will read as -12.
5.00 bar setpoint will read as 500.

Whilst the decimal precision is different for different items, it will not change for any particular item during normal use.

When an NXTSD104 or NX6330 touch screen is being used in a 'twin firing' configuration, these items relate to the left-hand-side (LHS) burner. The list of functions for the right-hand-side (RHS) burner can be found by adding 10000 to the register number / address. The NX6110 and NX6220 displays do not currently support twin firing configurations.

When the display is being used with a water-level control / expansion unit, modbus functions relating to that unit can be accessed by adding 20000 to the register address. In this case, see Table 8 on page 36 below.

Table 7:

READ ONLY	*HOLDING REGISTERS*	(BURNER CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
1	0	Drive 0 Position	As on product display.
2	1	Drive 1 Position	As on product display.
3	2	Drive 2 Position	As on product display.
4	3	Drive 3 Position	As on product display.
5	4	Drive 4 Position	As on product display.
6	5	Drive 5 Position	As on product display.
7	6	Drive 6 Position	As on product display.
8	7	Drive 7 Position	As on product display.

READ ONLY	HOLDING REGISTERS	(BURNER CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
9	8	Drive 8 Position	As on product display.
10	9	Drive 9 Position	As on product display.
11	10	Spare	Do not use
12	11	Spare	Do not use
13	12	Measured Value	As on product display.
14	13	Efficiency	As on product display.
15	14	Inlet Temp	As on product display.
16	15	O2 Level	As on product display.
17	16	CO2 Level	As on product display.
18	17	Spare	
19	18	Hours Run	As on product display.
20	19	Burner Status	As on product display.
21	20	Trim	As on product display.
22	21	Setpoint	As on product display.
23	22	Flue Temp	As on product display.
24	23	Fault Number	As on product display.
25	24	Spare	
26	25	Spare	
27	26	Spare	
28	27	Profile Number	As on product display.
29	28	Do not use.	
30	29	Do not use.	
31	30	Modulation Rate	As on product display.
32	31	Spare	
33	32	Spare	
34	33	Spare	
35	34	Spare	
36	35	Gas Pressure	As on product display.
37	36	Valve Prove Status	As on product display.
38	37	Flame Signal	As on product display.
39	38	2nd Flame Signal	UV level if IR is used
40…99	39…98	Reserved for future use	
100	99	Touchscreen firmware providing modbus TCP.	The firmware version of the touchscreen version
101	100	Engineers Key 0	See product manual ‘EK’ list
102	101	Engineers Key 1	See product manual ‘EK’ list
103	102	Engineers Key 2	See product manual ‘EK’ list
104	103	Engineers Key 3	See product manual ‘EK’ list
105	104	Engineers Key 4	See product manual ‘EK’ list
106	105	Engineers Key 5	See product manual ‘EK’ list
107	106	Engineers Key 6	See product manual ‘EK’ list
108	107	Engineers Key 7	See product manual ‘EK’ list

READ ONLY	HOLDING REGISTERS	(BURNER CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
109	108	Engineers Key 8	See product manual 'EK' list
110	109	Engineers Key 9	See product manual 'EK' list
111	110	Engineers Key 10	See product manual 'EK' list
112	111	Engineers Key 11	See product manual 'EK' list
113	112	Engineers Key 12	See product manual 'EK' list
114	113	Engineers Key 13	See product manual 'EK' list
115	114	Engineers Key 14	See product manual 'EK' list
116	115	Engineers Key 15	See product manual 'EK' list
117	116	Engineers Key 16	See product manual 'EK' list
118	117	Engineers Key 17	See product manual 'EK' list
119	118	Engineers Key 18	See product manual 'EK' list
120	119	Engineers Key 19	See product manual 'EK' list
121	120	Engineers Key 20	See product manual 'EK' list
122	121	Engineers Key 21	See product manual 'EK' list
123	122	Engineers Key 22	See product manual 'EK' list
124	123	Engineers Key 23	See product manual 'EK' list
125	124	Engineers Key 24	See product manual 'EK' list
126	125	Engineers Key 25	See product manual 'EK' list
127	126	Engineers Key 26	See product manual 'EK' list
128	127	Engineers Key 27	See product manual 'EK' list
129	128	Engineers Key 28	See product manual 'EK' list
130	129	Engineers Key 29	See product manual 'EK' list
131	130	Engineers Key 30	See product manual 'EK' list
132	131	Engineers Key 31	See product manual 'EK' list
133	132	Engineers Key 32	See product manual 'EK' list
134	133	Engineers Key 33	See product manual 'EK' list
135	134	Engineers Key 34	See product manual 'EK' list
136	135	Engineers Key 35	See product manual 'EK' list
137	136	Engineers Key 36	See product manual 'EK' list
138	137	Engineers Key 37	See product manual 'EK' list
139	138	Engineers Key 38	See product manual 'EK' list
140	139	Engineers Key 39	See product manual 'EK' list
141	140	Engineers Key 40	See product manual 'EK' list
142	141	Engineers Key 41	See product manual 'EK' list
143	142	Engineers Key 42	See product manual 'EK' list
144	143	Engineers Key 43	See product manual 'EK' list
145	144	Engineers Key 44	See product manual 'EK' list
146	145	Engineers Key 45	See product manual 'EK' list
147	146	Engineers Key 46	See product manual 'EK' list
148	147	Engineers Key 47	See product manual 'EK' list
149	148	Engineers Key 48	See product manual 'EK' list
150	149	Engineers Key 49	See product manual 'EK' list
151	150	Engineers Key 50	See product manual 'EK' list

READ ONLY	HOLDING REGISTERS	(BURNER CONTROLS)	
Register Number	Register Address	Function	Details
152	151	Engineers Key 51	See product manual ‘EK’ list
153	152	Engineers Key 52	See product manual ‘EK’ list
154	153	Engineers Key 53	See product manual ‘EK’ list
155	154	Engineers Key 54	See product manual ‘EK’ list
156	155	Engineers Key 55	See product manual ‘EK’ list
157	156	Engineers Key 56	See product manual ‘EK’ list
158	157	Engineers Key 57	See product manual ‘EK’ list
159	158	Engineers Key 58	See product manual ‘EK’ list
160	159	Engineers Key 59	See product manual ‘EK’ list
161	160	Engineers Key 60	See product manual ‘EK’ list
162	161	Engineers Key 61	See product manual ‘EK’ list
163	162	Engineers Key 62	See product manual ‘EK’ list
164	163	Engineers Key 63	See product manual ‘EK’ list
165	164	Engineers Key 64	See product manual ‘EK’ list
166	165	Engineers Key 65	See product manual ‘EK’ list
167	166	Engineers Key 66	See product manual ‘EK’ list
168	167	Engineers Key 67	See product manual ‘EK’ list
169	168	Engineers Key 68	See product manual ‘EK’ list
170	169	Engineers Key 69	See product manual ‘EK’ list
171	170	Engineers Key 70	See product manual ‘EK’ list
172	171	Engineers Key 71	See product manual ‘EK’ list
173	172	Engineers Key 72	See product manual ‘EK’ list
174	173	Engineers Key 73	See product manual ‘EK’ list
175	174	Engineers Key 74	See product manual ‘EK’ list
176	175	Engineers Key 75	See product manual ‘EK’ list
177	176	Engineers Key 76	See product manual ‘EK’ list
178	177	Engineers Key 77	See product manual ‘EK’ list
179	178	Engineers Key 78	See product manual ‘EK’ list
180	179	Engineers Key 79	See product manual ‘EK’ list
181	180	Engineers Key 80	See product manual ‘EK’ list
182	181	Engineers Key 81	See product manual ‘EK’ list
183	182	Engineers Key 82	See product manual ‘EK’ list
184	183	Engineers Key 83	See product manual ‘EK’ list
185	184	Engineers Key 84	See product manual ‘EK’ list
186	185	Engineers Key 85	See product manual ‘EK’ list
187	186	Engineers Key 86	See product manual ‘EK’ list
188	187	Engineers Key 87	See product manual ‘EK’ list
189	188	Engineers Key 88	See product manual ‘EK’ list
190	189	Engineers Key 89	See product manual ‘EK’ list
191	190	Engineers Key 90	See product manual ‘EK’ list
192	191	Engineers Key 91	See product manual ‘EK’ list
193	192	Engineers Key 92	See product manual ‘EK’ list
194	193	Engineers Key 93	See product manual ‘EK’ list

READ ONLY	HOLDING REGISTERS	(BURNER CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
195	194	Engineers Key 94	See product manual 'EK' list
196	195	Engineers Key 95	See product manual 'EK' list
197	196	Engineers Key 96	See product manual 'EK' list
198	197	Engineers Key 97	See product manual 'EK' list
199	198	Engineers Key 98	See product manual 'EK' list
200	199	Engineers Key 99	See product manual 'EK' list
201	200	Engineers Key 100	See product manual 'EK' list
202	201	Engineers Key 101	See product manual 'EK' list
203	202	Engineers Key 102	See product manual 'EK' list
204	203	Engineers Key 103	See product manual 'EK' list
205	204	Engineers Key 104	See product manual 'EK' list
206	205	Engineers Key 105	See product manual 'EK' list
207	206	Engineers Key 106	See product manual 'EK' list
208	207	Engineers Key 107	See product manual 'EK' list
209	208	Engineers Key 108	See product manual 'EK' list
210	209	Engineers Key 109	See product manual 'EK' list
211	210	Engineers Key 110	See product manual 'EK' list
212	211	Engineers Key 111	See product manual 'EK' list
213	212	Engineers Key 112	See product manual 'EK' list
214	213	Engineers Key 113	See product manual 'EK' list
215	214	Engineers Key 114	See product manual 'EK' list
216	215	Engineers Key 115	See product manual 'EK' list
217	216	Engineers Key 116	See product manual 'EK' list
218	217	Engineers Key 117	See product manual 'EK' list
219	218	Engineers Key 118	See product manual 'EK' list
220	219	Engineers Key 119	See product manual 'EK' list
221	220	Engineers Key 120	See product manual 'EK' list
222	221	Engineers Key 121	See product manual 'EK' list
223	222	Engineers Key 122	See product manual 'EK' list
224	223	Engineers Key 123	See product manual 'EK' list
225	224	Engineers Key 124	See product manual 'EK' list
226	225	Engineers Key 125	See product manual 'EK' list
227	226	Engineers Key 126	See product manual 'EK' list
228	227	Engineers Key 127	See product manual 'EK' list
229	228	Engineers Key 128	See product manual 'EK' list
230	229	Engineers Key 129	See product manual 'EK' list
231	230	Engineers Key 130	See product manual 'EK' list
232	231	Engineers Key 131	See product manual 'EK' list
233	232	Engineers Key 132	See product manual 'EK' list
234	233	Engineers Key 133	See product manual 'EK' list
235	234	Engineers Key 134	See product manual 'EK' list
236	235	Engineers Key 135	See product manual 'EK' list
237	236	Engineers Key 136	See product manual 'EK' list

READ ONLY	HOLDING REGISTERS	(BURNER CONTROLS)	
Register Number	Register Address	Function	Details
238	237	Engineers Key 137	See product manual ‘EK’ list
239	238	Engineers Key 138	See product manual ‘EK’ list
240	239	Engineers Key 139	See product manual ‘EK’ list
241	240	Engineers Key 140	See product manual ‘EK’ list
242	241	Engineers Key 141	See product manual ‘EK’ list
243	242	Engineers Key 142	See product manual ‘EK’ list
244	243	Engineers Key 143	See product manual ‘EK’ list
245	244	Engineers Key 144	See product manual ‘EK’ list
246	245	Engineers Key 145	See product manual ‘EK’ list
247	246	Engineers Key 146	See product manual ‘EK’ list
248	247	Engineers Key 147	See product manual ‘EK’ list
249	248	Engineers Key 148	See product manual ‘EK’ list
250	249	Engineers Key 149	See product manual ‘EK’ list
251	250	Engineers Key 150	See product manual ‘EK’ list
252	251	Engineers Key 151	See product manual ‘EK’ list
253	252	Engineers Key 152	See product manual ‘EK’ list
254	253	Engineers Key 153	See product manual ‘EK’ list
255	254	Engineers Key 154	See product manual ‘EK’ list
256	255	Engineers Key 155	See product manual ‘EK’ list
257	256	Engineers Key 156	See product manual ‘EK’ list
258	257	Engineers Key 157	See product manual ‘EK’ list
259	258	Engineers Key 158	See product manual ‘EK’ list
260	259	Engineers Key 159	See product manual ‘EK’ list
261	260	Engineers Key 160	See product manual ‘EK’ list
262	261	Engineers Key 161	See product manual ‘EK’ list
263	262	Engineers Key 162	See product manual ‘EK’ list
264	263	Engineers Key 163	See product manual ‘EK’ list
265	264	Engineers Key 164	See product manual ‘EK’ list
266	265	Engineers Key 165	See product manual ‘EK’ list
267	266	Engineers Key 166	See product manual ‘EK’ list
268	267	Engineers Key 167	See product manual ‘EK’ list
269	268	Engineers Key 168	See product manual ‘EK’ list
270	269	Engineers Key 169	See product manual ‘EK’ list
271	270	Engineers Key 170	See product manual ‘EK’ list
272	271	Engineers Key 171	See product manual ‘EK’ list
273	272	Engineers Key 172	See product manual ‘EK’ list
274	273	Engineers Key 173	See product manual ‘EK’ list
275	274	Engineers Key 174	See product manual ‘EK’ list
276	275	Engineers Key 175	See product manual ‘EK’ list
277	276	Engineers Key 176	See product manual ‘EK’ list
278	277	Engineers Key 177	See product manual ‘EK’ list
279	278	Engineers Key 178	See product manual ‘EK’ list
280	279	Engineers Key 179	See product manual ‘EK’ list

READ ONLY	HOLDING REGISTERS	(BURNER CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
281	280	Engineers Key 180	See product manual 'EK' list
282	281	Engineers Key 181	See product manual 'EK' list
283	282	Engineers Key 182	See product manual 'EK' list
284	283	Engineers Key 183	See product manual 'EK' list
285	284	Engineers Key 184	See product manual 'EK' list
286	285	Engineers Key 185	See product manual 'EK' list
287	286	Engineers Key 186	See product manual 'EK' list
288	287	Engineers Key 187	See product manual 'EK' list
289	288	Engineers Key 188	See product manual 'EK' list
290	289	Engineers Key 189	See product manual 'EK' list
291	290	Engineers Key 190	See product manual 'EK' list
292	291	Engineers Key 191	See product manual 'EK' list
293	292	Engineers Key 192	See product manual 'EK' list
294	293	Engineers Key 193	See product manual 'EK' list
295	294	Engineers Key 194	See product manual 'EK' list
296	295	Engineers Key 195	See product manual 'EK' list
297	296	Engineers Key 196	See product manual 'EK' list
298	297	Engineers Key 197	See product manual 'EK' list
299	298	Engineers Key 198	See product manual 'EK' list
300	299	Engineers Key 199	See product manual 'EK' list
301	300	Engineers Key 200	See product manual 'EK' list

Table 8: **Water Level Controls**

READ ONLY	HOLDING REGISTERS	(WATER LEVEL CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
20013	20012	Measured water level	As on product display.
20020	20019	Controller status	0 = Fault, 1 = Working
20022	20021	Water level setpoint	Available on controller firmware 1.117 and later.
20031	20030	Valve / pump output	10 = 1.0% (minimum) 999 = 99.9% maximum.
20051	20050	Measured water level	As register address 20012
20052	20051	TDS level	OPTIONAL. Total dissolved solids in units as calibrated (ppm, uS…)
20053	20052	Feed-water flow rate	
20054	20053	Feed-water temperature	
20055	20054	Steam flow rate	
20056	20055	Steam temperature	OPTIONAL.
20056	20056	Economiser water inlet temperature	OPTIONAL.
20058	20057	Economiser flue out temperature	OPTIONAL.
20059	20058	Economiser heat recovered kW	OPTIONAL.

READ ONLY	*HOLDING REGISTERS*	(WATER LEVEL CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
20060	20059	Economiser heat recovered %	OPTIONAL
20101	20100	Engineers Key 0	See water level manual ‘EK’ list
20102	20101	Engineers Key 1	See water level manual ‘EK’ list
20103	20102	Engineers Key 2	See water level manual ‘EK’ list
20104	20103	Engineers Key 3	See water level manual ‘EK’ list
20105	20104	Engineers Key 4	See water level manual ‘EK’ list
20106	20105	Engineers Key 5	See water level manual ‘EK’ list
20107	20106	Engineers Key 6	See water level manual ‘EK’ list
20108	20107	Engineers Key 7	See water level manual ‘EK’ list
20109	20108	Engineers Key 8	See water level manual ‘EK’ list
20110	20109	Engineers Key 9	See water level manual ‘EK’ list
20111	20110	Engineers Key 10	See water level manual ‘EK’ list
20112	20111	Engineers Key 11	See water level manual ‘EK’ list
20113	20112	Engineers Key 12	See water level manual ‘EK’ list
20114	20113	Engineers Key 13	See water level manual ‘EK’ list
20115	20114	Engineers Key 14	See water level manual ‘EK’ list
20116	20115	Engineers Key 15	See water level manual ‘EK’ list
20117	20116	Engineers Key 16	See water level manual ‘EK’ list
20118	20117	Engineers Key 17	See water level manual ‘EK’ list
20119	20118	Engineers Key 18	See water level manual ‘EK’ list
20120	20119	Engineers Key 19	See water level manual ‘EK’ list
20121	20120	Engineers Key 20	See water level manual ‘EK’ list
20122	20121	Engineers Key 21	See water level manual ‘EK’ list
20123	20122	Engineers Key 22	See water level manual ‘EK’ list
20124	20123	Engineers Key 23	See water level manual ‘EK’ list
20125	20124	Engineers Key 24	See water level manual ‘EK’ list
20126	20125	Engineers Key 25	See water level manual ‘EK’ list
20127	20126	Engineers Key 26	See water level manual ‘EK’ list
20128	20127	Engineers Key 27	See water level manual ‘EK’ list
20129	20128	Engineers Key 28	See water level manual ‘EK’ list
20130	20129	Engineers Key 29	See water level manual ‘EK’ list
20131	20130	Engineers Key 30	See water level manual ‘EK’ list
20132	20131	Engineers Key 31	See water level manual ‘EK’ list
20133	20132	Engineers Key 32	See water level manual ‘EK’ list
20134	20133	Engineers Key 33	See water level manual ‘EK’ list
20135	20134	Engineers Key 34	See water level manual ‘EK’ list
20136	20135	Engineers Key 35	See water level manual ‘EK’ list
20137	20136	Engineers Key 36	See water level manual ‘EK’ list
20138	20137	Engineers Key 37	See water level manual ‘EK’ list
20139	20138	Engineers Key 38	See water level manual ‘EK’ list
20140	20139	Engineers Key 39	See water level manual ‘EK’ list
20141	20140	Engineers Key 40	See water level manual ‘EK’ list

READ ONLY	*HOLDING REGISTERS*	(WATER LEVEL CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
20142	20141	Engineers Key 41	See water level manual 'EK' list
20143	20142	Engineers Key 42	See water level manual 'EK' list
20144	20143	Engineers Key 43	See water level manual 'EK' list
20145	20144	Engineers Key 44	See water level manual 'EK' list
20146	20145	Engineers Key 45	See water level manual 'EK' list
20147	20146	Engineers Key 46	See water level manual 'EK' list
20148	20147	Engineers Key 47	See water level manual 'EK' list
20149	20148	Engineers Key 48	See water level manual 'EK' list
20150	20149	Engineers Key 49	See water level manual 'EK' list
20151	20150	Engineers Key 50	See water level manual 'EK' list
20152	20151	Engineers Key 51	See water level manual 'EK' list
20153	20152	Engineers Key 52	See water level manual 'EK' list
20154	20153	Engineers Key 53	See water level manual 'EK' list
20155	20154	Engineers Key 54	See water level manual 'EK' list
20156	20155	Engineers Key 55	See water level manual 'EK' list
20157	20156	Engineers Key 56	See water level manual 'EK' list
20158	20157	Engineers Key 57	See water level manual 'EK' list
20159	20158	Engineers Key 58	See water level manual 'EK' list
20160	20159	Engineers Key 59	See water level manual 'EK' list
20161	20160	Engineers Key 60	See water level manual 'EK' list
20162	20161	Engineers Key 61	See water level manual 'EK' list
20163	20162	Engineers Key 62	See water level manual 'EK' list
20164	20163	Engineers Key 63	See water level manual 'EK' list
20165	20164	Engineers Key 64	See water level manual 'EK' list
20166	20165	Engineers Key 65	See water level manual 'EK' list
20167	20166	Engineers Key 66	See water level manual 'EK' list
20168	20167	Engineers Key 67	See water level manual 'EK' list
20169	20168	Engineers Key 68	See water level manual 'EK' list
20170	20169	Engineers Key 69	See water level manual 'EK' list
20171	20170	Engineers Key 70	See water level manual 'EK' list
20172	20171	Engineers Key 71	See water level manual 'EK' list
20173	20172	Engineers Key 72	See water level manual 'EK' list
20174	20173	Engineers Key 73	See water level manual 'EK' list
20175	20174	Engineers Key 74	See water level manual 'EK' list
20176	20175	Engineers Key 75	See water level manual 'EK' list
20177	20176	Engineers Key 76	See water level manual 'EK' list
20178	20177	Engineers Key 77	See water level manual 'EK' list
20179	20178	Engineers Key 78	See water level manual 'EK' list
20180	20179	Engineers Key 79	See water level manual 'EK' list
20181	20180	Engineers Key 80	See water level manual 'EK' list
20182	20181	Engineers Key 81	See water level manual 'EK' list
20183	20182	Engineers Key 82	See water level manual 'EK' list
20184	20183	Engineers Key 83	See water level manual 'EK' list

READ ONLY	*HOLDING REGISTERS*	(WATER LEVEL CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
20185	20184	Engineers Key 84	See water level manual 'EK' list
20186	20185	Engineers Key 85	See water level manual 'EK' list
20187	20186	Engineers Key 86	See water level manual 'EK' list
20188	20187	Engineers Key 87	See water level manual 'EK' list
20189	20188	Engineers Key 88	See water level manual 'EK' list
20190	20189	Engineers Key 89	See water level manual 'EK' list
20191	20190	Engineers Key 90	See water level manual 'EK' list
20192	20191	Engineers Key 91	See water level manual 'EK' list
20193	20192	Engineers Key 92	See water level manual 'EK' list
20194	20193	Engineers Key 93	See water level manual 'EK' list
20195	20194	Engineers Key 94	See water level manual 'EK' list
20196	20195	Engineers Key 95	See water level manual 'EK' list
20197	20196	Engineers Key 96	See water level manual 'EK' list
20198	20197	Engineers Key 97	See water level manual 'EK' list
20199	20198	Engineers Key 98	See water level manual 'EK' list
20200	20199	Engineers Key 99	See water level manual 'EK' list
20201	20200	Engineers Key 100	See water level manual 'EK' list
20202	20201	Engineers Key 101	See water level manual 'EK' list
20203	20202	Engineers Key 102	See water level manual 'EK' list
20204	20203	Engineers Key 103	See water level manual 'EK' list
20205	20204	Engineers Key 104	See water level manual 'EK' list
20206	20205	Engineers Key 105	See water level manual 'EK' list
20207	20206	Engineers Key 106	See water level manual 'EK' list
20208	20207	Engineers Key 107	See water level manual 'EK' list
20209	20208	Engineers Key 108	See water level manual 'EK' list
20210	20209	Engineers Key 109	See water level manual 'EK' list
20211	20210	Engineers Key 110	See water level manual 'EK' list
20212	20211	Engineers Key 111	See water level manual 'EK' list
20213	20212	Engineers Key 112	See water level manual 'EK' list
20214	20213	Engineers Key 113	See water level manual 'EK' list
20215	20214	Engineers Key 114	See water level manual 'EK' list
20216	20215	Engineers Key 115	See water level manual 'EK' list
20217	20216	Engineers Key 116	See water level manual 'EK' list
20218	20217	Engineers Key 117	See water level manual 'EK' list
20219	20218	Engineers Key 118	See water level manual 'EK' list
20220	20219	Engineers Key 119	See water level manual 'EK' list
20221	20220	Engineers Key 120	See water level manual 'EK' list
20222	20221	Engineers Key 121	See water level manual 'EK' list
20223	20222	Engineers Key 122	See water level manual 'EK' list
20224	20223	Engineers Key 123	See water level manual 'EK' list
20225	20224	Engineers Key 124	See water level manual 'EK' list
20226	20225	Engineers Key 125	See water level manual 'EK' list
20227	20226	Engineers Key 126	See water level manual 'EK' list

READ ONLY	*HOLDING REGISTERS*	(WATER LEVEL CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
20228	20227	Engineers Key 127	See water level manual ‘EK’ list
20229	20228	Engineers Key 128	See water level manual ‘EK’ list
20230	20229	Engineers Key 129	See water level manual ‘EK’ list
20231	20230	Engineers Key 130	See water level manual ‘EK’ list
20232	20231	Engineers Key 131	See water level manual ‘EK’ list
20233	20232	Engineers Key 132	See water level manual ‘EK’ list
20234	20233	Engineers Key 133	See water level manual ‘EK’ list
20235	20234	Engineers Key 134	See water level manual ‘EK’ list
20236	20235	Engineers Key 135	See water level manual ‘EK’ list
20237	20236	Engineers Key 136	See water level manual ‘EK’ list
20238	20237	Engineers Key 137	See water level manual ‘EK’ list
20239	20238	Engineers Key 138	See water level manual ‘EK’ list
20240	20239	Engineers Key 139	See water level manual ‘EK’ list
20241	20240	Engineers Key 140	See water level manual ‘EK’ list
20242	20241	Engineers Key 141	See water level manual ‘EK’ list
20243	20242	Engineers Key 142	See water level manual ‘EK’ list
20244	20243	Engineers Key 143	See water level manual ‘EK’ list
20245	20244	Engineers Key 144	See water level manual ‘EK’ list
20246	20245	Engineers Key 145	See water level manual ‘EK’ list
20247	20246	Engineers Key 146	See water level manual ‘EK’ list
20248	20247	Engineers Key 147	See water level manual ‘EK’ list
20249	20248	Engineers Key 148	See water level manual ‘EK’ list
20250	20249	Engineers Key 149	See water level manual ‘EK’ list
20251	20250	Engineers Key 150	See water level manual ‘EK’ list
20252	20251	Engineers Key 151	See water level manual ‘EK’ list
20253	20252	Engineers Key 152	See water level manual ‘EK’ list
20254	20253	Engineers Key 153	See water level manual ‘EK’ list
20255	20254	Engineers Key 154	See water level manual ‘EK’ list
20256	20255	Engineers Key 155	See water level manual ‘EK’ list
20257	20256	Engineers Key 156	See water level manual ‘EK’ list
20258	20257	Engineers Key 157	See water level manual ‘EK’ list
20259	20258	Engineers Key 158	See water level manual ‘EK’ list
20260	20259	Engineers Key 159	See water level manual ‘EK’ list
20261	20260	Engineers Key 160	See water level manual ‘EK’ list
20262	20261	Engineers Key 161	See water level manual ‘EK’ list
20263	20262	Engineers Key 162	See water level manual ‘EK’ list
20264	20263	Engineers Key 163	See water level manual ‘EK’ list
20265	20264	Engineers Key 164	See water level manual ‘EK’ list
20266	20265	Engineers Key 165	See water level manual ‘EK’ list
20267	20266	Engineers Key 166	See water level manual ‘EK’ list
20268	20267	Engineers Key 167	See water level manual ‘EK’ list
20269	20268	Engineers Key 168	See water level manual ‘EK’ list
20270	20269	Engineers Key 169	See water level manual ‘EK’ list

READ ONLY	*HOLDING REGISTERS*	(WATER LEVEL CONTROLS)	
Register Number	*Register Address*	*Function*	*Details*
20271	20270	Engineers Key 170	See water level manual 'EK' list
20272	20271	Engineers Key 171	See water level manual 'EK' list
20273	20272	Engineers Key 172	See water level manual 'EK' list
20274	20273	Engineers Key 173	See water level manual 'EK' list
20275	20274	Engineers Key 174	See water level manual 'EK' list
20276	20275	Engineers Key 175	See water level manual 'EK' list
20277	20276	Engineers Key 176	See water level manual 'EK' list
20278	20277	Engineers Key 177	See water level manual 'EK' list
20279	20278	Engineers Key 178	See water level manual 'EK' list
20280	20279	Engineers Key 179	See water level manual 'EK' list
20281	20280	Engineers Key 180	See water level manual 'EK' list
20282	20281	Engineers Key 181	See water level manual 'EK' list
20283	20282	Engineers Key 182	See water level manual 'EK' list
20284	20283	Engineers Key 183	See water level manual 'EK' list
20285	20284	Engineers Key 184	See water level manual 'EK' list
20286	20285	Engineers Key 185	See water level manual 'EK' list
20287	20286	Engineers Key 186	See water level manual 'EK' list
20288	20287	Engineers Key 187	See water level manual 'EK' list
20289	20288	Engineers Key 188	See water level manual 'EK' list
20290	20289	Engineers Key 189	See water level manual 'EK' list
20291	20290	Engineers Key 190	See water level manual 'EK' list
20292	20291	Engineers Key 191	See water level manual 'EK' list
20293	20292	Engineers Key 192	See water level manual 'EK' list
20294	20293	Engineers Key 193	See water level manual 'EK' list
20295	20294	Engineers Key 194	See water level manual 'EK' list
20296	20295	Engineers Key 195	See water level manual 'EK' list
20297	20296	Engineers Key 196	See water level manual 'EK' list
20298	20297	Engineers Key 197	See water level manual 'EK' list
20299	20298	Engineers Key 198	See water level manual 'EK' list
20300	20299	Engineers Key 199	See water level manual 'EK' list
20301	20300	Engineers Key 200	See water level manual 'EK' list

Table 9: **Control Functions:**

		READ / WRITE HOLDING REGISTERS	***Note that reading these only returns values previously written.***
Regieter Number	***Register Address***	***Function***	***Details***
801	800	Setpoint 1 Control Value	Strip decimal information – i.e. 999 = 99.9 = 9.99
802	801	Setpoint 2 Control Value	Strip decimal information – i.e. 999 = 99.9 = 9.99
803	802	Setpoint 1 Low Control Limit99.9 = 9.99	Strip decimal information – i.e. 999 =
804	803	Setpoint 2 Low Control Limit99.9 = 9.99	Strip decimal information – i.e. 999 =

805	804	Setpoint 1 High Control Limit99.9 = 9.99	Strip decimal information – i.e. 999 =
806	805	Setpoint 2 High Control Limit99.9 = 9.99	Strip decimal information – i.e. 999 =
807	806	Modulation Rate	0 = low fire, 999 = high fire. This register MUST NOT be written to if the controls built-in boiler sequencing is being used unless this is the lead boiler.
808 – 816	807 – 815	Reserved for future use.	

Table 10: **Burnerlogix registers only available with NXTSD104 touchscreen :**

Register Number	*Register Address*	*READ ONLY HOLDING REGISTERS (FIREYE) Function*	*Only available when used in conjunction with FIREYE PPC6000 / Burnerlogix. Details*
901	900	STATUS	See BL-1001
902		MSGN	See BL-1001
903		GSTAT	See BL-1001
904		TIMER	See BL-1001
905		FLAME	See BL-1001
906		LOGSTAT	See BL-1001
907		INPUTS	See BL-1001
908		OUTPUTS	See BL-1001
909 – 910	908 – 909	SYSMINS	See BL-1001
911 – 912	910 – 911	BNRMINS	See BL-1001
913 – 914	912 – 913	CYCLES	See BL-1001
915	914	LOCKOUT COUNT	See BL-1001
916 - 921	915 - 920	MOST RECENT LOCKOUT	See BL-1001

5.5 Read Discrete Inputs (Function Code 2)

NXTSD104 and NX6330 ONLY. NOT CURRENTLY AVAILABLE ON NX6110 or NX6220.

Modbus function code 2 can be used the read the status of the touch-screens on-board line voltage inputs (if present). These inputs are typically used to read plant status signals and are available on the screen under the 'Plant Inputs' menu (select 'Screen Inputs'). The NX6110 and NX6220 displays do not have these inputs.

NOTE : This function is only supported for screens that have been supplied with the required hardware and requires touch-screen firmware version 2.203 or higher. Contact your supplier if a firmware update is required.

The digital functions from the 'engineers key' list can be read here. These are the same values as available from the holding registers and input registers but it is more efficient to read them from here because they will be sent as binary values (ON or OFF) rather than 16 of 32 bit numbers that will only ever have values of 0 or 1.

Note that not all EK values are valid for all controls.

Additionally, for integrated burner controls, the status of the fuel valve and other output relays can be read from this list. This information is not currently available in the EK list.

Table 11:

Discrete Input Status			
Register Number	***Register Address***	***Function***	***Details***
1	0	Screen Input 1	PS1
2	1	Screen Input 2	PS2
3	2	Screen Input 3	PS3
4	3	Screen Input 4	PS4
5	4	Screen Input 5	PS4
6	5	Screen Input 6	PS6
7	6	Screen Input 7	PS7
8	7	Screen Input 8	PS8
9	8	Screen Input 9	PS9
10	9	Screen Input 10	PS10
			PS11 – no connection
			PS12 – Neutral / L2
11	10	Control digital input 1	EK1 (see manual)
12	11	Control digital input 2	EK2 (see manual)
13	12	Control digital input 3	EK3 (see manual)
14	13	Control digital input 4	EK4 (see manual)
15	14	Control digital input 5	EK5 (see manual)
16	15	Control digital input 6	EK6 (see manual)
17	16	Control digital input 7	EK7 (see manual)
18	17	Control digital input 8	EK8 (see manual)
19	18	Control digital input 9	EK9 (see manual)
20	19	Control digital input 10	EK10 (see manual)
21	20	Control digital input 11	EK11 (see manual)
22	21	Control digital input 12	EK12 (see manual)
23	22	Control digital input 13	EK13 (see manual)
24	23	Control digital input 14	EK14 (see manual)
25	24	Air pressure Input	EK15 (see manual)
26	25	Low Fire Hold / Warming Limit	EK16 (see manual)
27	26	Flame Detected	EK17 (see manual)
28	27	Boiler Status	EK18 (see manual)
29	28	Confirm to adjust	EK19 (see manual)
30	29	Drive Moved	EK20 (see manual)

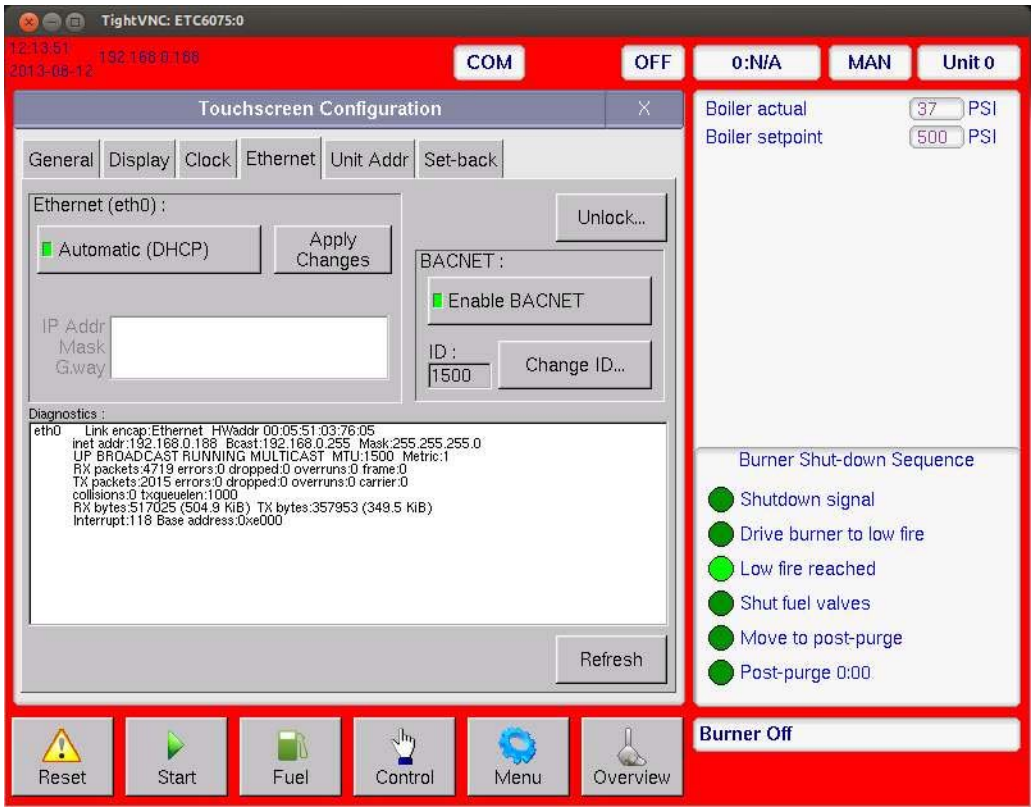
Discrete Input Status			
Register Number	Register Address	Function	Details
31	30	Positions proved	EK21(see manual)
32	31	Fault Alarm	EK22 (see manual)
33	32	Oxygen Trim Enabled	EK23(see manual)
34	33	Oil Warming Active	EK24(see manual)
35	34	Fan relay status	1 = relay ON
36	35	Ignition relay status	1 = relay ON
37	36	Pilot valve relay status	1 = relay ON
38	37	Gas valve 1 relay status	1 = relay ON
39	38	Gas valve 2 relay status	1 = relay ON
40	39	Oil valve 1 relay status	1 = relay ON
41	40	Oil valve 2 relay status	1 = relay ON
42	41	Oil pump / aux relay status	1 = relay ON
43	42	Vent valve relay status	1 = relay ON
44	43	Remotely controlled	TRUE if the burner is being controlled remotely so that the display shows REM as the operation mode.
45	44	LEAD boiler	TRUE if this boiler is operating as the LEAD boiler in a boiler sequencing (lead-lag) system
46	45	LAG boiler	TRUE if this boiler is operating as a LAG (slave) boiler in a boiler sequencing (lead-lag) system.
47	46	LAG ON	This is a LAG boiler (as above) and is currently being commanded to fire.
48	47	LAG WARMING	This is a LAG boiler (as above) and is currently being commanded to be off but
49	48	LAG OFF	This is a LAG boiler (as above) and is currently being commanded to switch off and is not currently in a warming (banking) cycle.

BACNET/IP Interface

6.1 Overview

BACNET/IP is available in NXTSD104 / NX6330 touch-screens with firmware version 2.200 and higher. Version 2 screens (firmware version >= 2.000) can be updated using a USB drive. Version 1 touch-screens cannot be updated to support BACNET/IP.

Before use, BACNET must be enabled from the 'Configuration - Ethernet' screen :



6.2 Implementation Details

Device objects / Instances

The BACNET device instance number must be set from the touchscreen. This is done from the Ethernet tab in the 'touchscreen configuration' scree. BACNET can be enabled / disabled from here also. Note that changing the BACNET settings will require the touchscreen to reboot.

In response to a 'who-is' scan, this system will show three devices : Directly Connected Router device :

This device will have the device instance number as set on the touchscreen (1500 in this example). This device object can be used to access the 6000 series control that is controlling the burner / boiler. In twin firing applications, this device will reflect the status of the left hand side (LHS) burner.

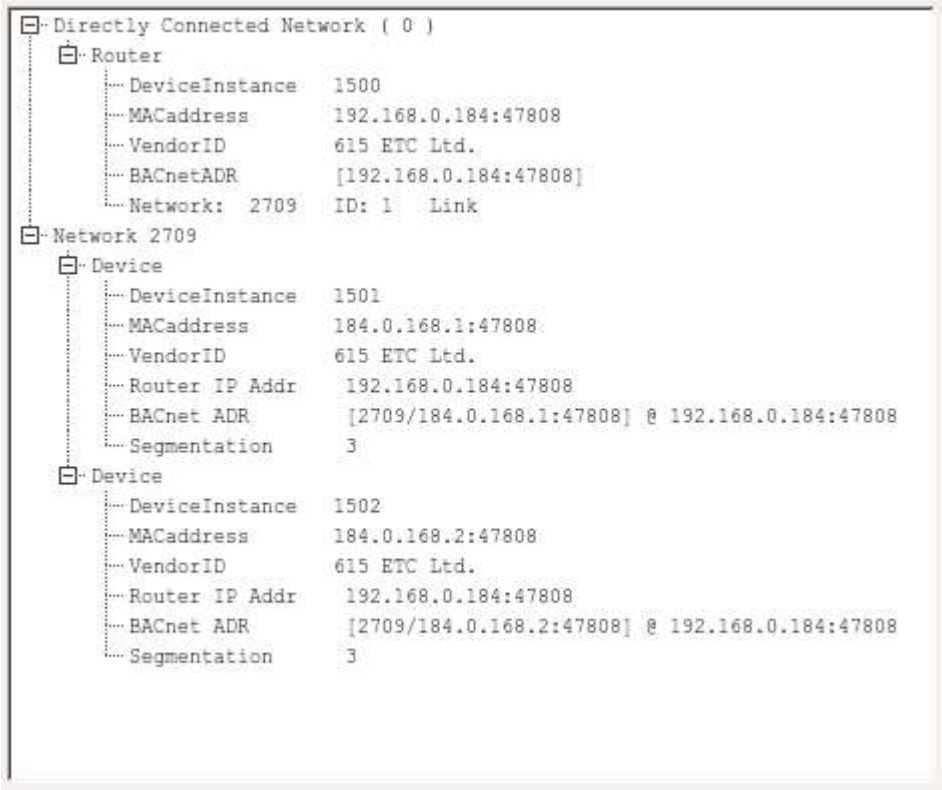
Network 2709 :

This is a virtual network implemented within the touch-screen. It provides no function other than to give access to two more devices which may or may not be routed to physical controls :

Device 1501 : This device will have a BACNET device number one greater than the instance number of the router device. This object provides access to a second 6000 series controller that may be used for twin firing

applications and will reflect the status of the right hand side (RHS) burner. Where there is only one burner per boiler, this BACNET device will still be present but should not be used.

Device 1502 : This device will have a BACNET device number two greater than the instance number of the router device. This object provides access to a 62xx expansion unit (if fitted). The expansion unit is a second control that is typically used for boiler water-level control or other functions. If there is no expansion unit fitted, this BACNET device will still be present but should not be used.



Each device has the following objects :

- Analog Values (Object type 2). There are 60 of these objects and these are used to read the main values of interest back from the connected controllers.
- Analog Inputs (Object type 0). There are 16 of these objects and these are used to read selected

'engineers key values' back from the controllers (if required). Note there are 200 possible test parameters that can be selected to be mapped to these 16 objects.

- Analog Outputs (Object type 1). There are 16 of these objects and these are used to control certain aspects of the control. For example, the PID running setpoint or modulation rate can be modified.
- Binary Outputs (Object type 4). There are 16 of these objects and these are used to control certain aspects of the control. For example, the burner can be switched off or fuel profiles changed (eg. Change from GAS to OIL).

6.3 Description of Objects

Analog Values (object type 2).

These values are listed below. Note that not all parameters will be available since this will depend on the system configuration. The following properties are most useful for these objects :

- PRESENT VALUE (85) READ ONLY
- DESCRIPTION (28) READ ONLY

Object Number	Function
0	Drive 0 Position
1	Drive 1 Position
2	Drive 2 Position
3	Drive 3 Position
4	Drive 4 Position
5	Drive 5 Position
6	Drive 6 Position
7	Drive 7 Position
8	Drive 8 Position
9	Drive 9 Position
10	Spare
11	Spare
12	Measured Value
13	Efficiency
14	Inlet Temp
15	O2 Level
16	CO2 Level
17	Spare / CO level
18	Hours Run
19	Burner Status
20	Oxygen Trim
21	Setpoint
22	Flue Temp
23	Fault Number
24	Spare
25	Spare
26	Spare
27	Profile Number
28	Do not use.
29	Do not use.
30	Modulation Rate

Object Number	Function
31	Analog Input 1
32	Analog Input 2
33	Spare
34	Spare
35	Gas Pressure
36	Valve Prove Status
37	Flame Signal
38	2nd Flame Signal
39	Combustion air pressure
40	Second Gas pressure
41	Spare
42	Spare
43	Spare
44	Spare
45	Spare
46	Spare
47	Spare
48	Spare
49	Spare
50	Water-level (from waterlevel expansion unit)
51	TDS (total dissolved solids – from waterlevel expansion unit)
52	Feed-water flow (from waterlevel expansion unit)
53	Feed-water temperature (from waterlevel expansion unit)
54	Steam flow (from waterlevel expansion unit)
55	Spare
56	Spare
57	Spare
58	Spare
59	Spare

Analog Inputs (Object type 0)

In most cases, these objects will not be used. There are 16 objects available to read extra values from the system 'engineers key' list. Since there are over 200 of these parameters available, it is not practical to provide an object for each. Instead, 16 analog input objects are provided. For each, there is a 'proprietary' property 9999 available which is used to select which system parameter is accessed by each analog input object.

See the product manual concerned for a list of all the EK values and their meanings. The following properties are most useful for these objects :

- PRESENT VALUE (85) READ ONLY
- DESCRIPTION (28) READ ONLY
- PROPRIETARY (9999) READ / WRITE

For example, to read EK56 (control firmware version) from analog input object 5:

- Write object 5 property 9999 = 56
- Read object 5 present value property (85) ----- returns 1.307 (for example)
- Read object 5 description property (28) ----- returns "Firmware Issue"

Note : These values may return zero the first time they are read if the touch-screen does not have this information cached. Also, if property 9999 is changed, the first read my return incorrect data. It is recommended that once property 9999 is set, these values are read frequently to keep them up to date.

Analog Outputs (Object type 1)

These objects can be used to override analog control functions of the connected controls. There are 16 objects available but most are currently unused.

Object Number	Function
0	Setpoint 1 Control Value
1	Setpoint 2 Control Value
2	Setpoint 1 Low Control Limit
3	Setpoint 2 Low Control Limit
4	Setpoint 1 High Control Limit
5	Setpoint 2 High Control Limit
6	Modulation Rate
7 to 15	Reserved for future use.

The following properties are most useful for these objects :

- PRESENT VALUE (85) READ / WRITE (PRIORITY ARRAY)
- OUT OF SERVICE (81) READ / WRITE

By default, all these objects will be flagged as out of service. To use a control function, the out of service flag must be cleared. After this, writing a value to the present value property will cause the specified control function to be overridden (provided the control is in AUTO and REMOTE modes).
Note that the present value property is implemented as a BACNET priority array which allows multiple devices to write to it and give a defined priority structure.

Binary Outputs (Object type 4)

These objects can be used to override digital control functions of the connected controls. There are 16 objects available.

Object Number	Function	Details
0	Setpoint Select	0 = Run to setpoint 1. 1 = Run to setpoint 2 (use for night setback etc.). This object MUST NOT be written to if the built-in boiler sequencing system is being used,
1	Release to Ignite	If used, must be 1 to allow the burner to ignite.
2	Low Fire Hold	0= Normal modulation. 1= Low Fire Hold.
3	Lead boiler Select	Choose this to be the lead boiler if boiler sequencing is in operation.
4	Mute / Reset	Due to differing approvals requirements, this function may be disabled. This object will mute the alarms and reset the fault, allowing the burner to restart. To do this, the register must be set to 1 for typically 5 seconds. Once the fault has been reset, or after 5 seconds, the register should be cleared. DO NOT SET THIS OBJECT TO 1 WHEN THERE ARE NO ALARMS TO MUTE. If this is repeatedly done, an F36 fault will lockout the burner. This fault cannot be reset remotely.
5	Oxygen Trim Enable	1 = Allow trim to be ON
6	Boiler Sequencing Enable	1 = Enable boiler sequencing (lead-lag). Must be done for every unit.
7	Burner ON/OFF	If the burner is firing / able to fire, it can be held OFF by writing a zero to this register.
8	Fault Mute Only	When set to 1, this register will mute fault alarms. Unlike object 4, this object will not cause the burner to restart if the fault has cleared, no matter how long it is left on for. As with the other object, it should be set to 0 after use. Compatibility note : This function requires controls with firmware versions 1.221 or greater. Also, these controls must have modulation program 41 or later installed (check EK 56 and EK 200).
9 – 10	Reserved	
11	Select Profile 1	1 = Force profile 1, 0 = Run with current profile. Integrated controls only.
12	Select Profile 2	1 = Force profile 2, 0 = Run with current profile. Integrated controls only.
13	Select Profile 3	1 = Force profile 3, 0 = Run with current profile. Integrated controls only.
14	Select Profile 4	1 = Force profile 4, 0 = Run with current profile. Integrated controls only.
15	Reserved	

The following properties are most useful for these objects :

- PRESENT VALUE (85) READ / WRITE (PRIORITY ARRAY)
- OUT OF SERVICE (81) READ / WRITE

By default, all these objects will be flagged as out of service. To use a control function, the out of service flag must be cleared. After this, writing a value to the present value property will cause the specified control function to be enabled.

Note that the present value property is implemented as a BACNET priority array which allows multiple devices to write to it and give a defined priority structure.

6.4 BACnet Protocol Implementation Conformance Statement

BACnet Standardized Device Profile (Annex L): NONE
BACnet Operator Workstation (B-OWS)
BACnet Advanced Operator Workstation (B-AWS)
BACnet Operator Display (B-OD)
BACnet Building Controller (B-BC)
BACnet Advanced Application Controller (B-AAC)
BACnet Application Specific Controller (B-ASC)
BACnet Smart Sensor (B-SS)
BACnet Smart Actuator (B-SA)
List all BACnet Interoperability Building Blocks Supported (Annex K): NONE
Segmentation Capability: NO
Data Link Layer Options:
BACnet IP, (Annex J)
Device Address Binding:
Static device binding is NOT supported
Networking Options:
Annex H, BACnet Tunneling Router over IP
Network Security Options:
Non-secure Device - is capable of operating without BACnet Network Security
Character Sets Supported:
ISO 10646 (UTF-8)

7. Specification.

7.1 MODbus RTU

Protocol	MODBUS RTU, 4800/9600/19200 baud, 8-bit, No parity, 1 stop bit. MODBUS Functions supported: 1 – Read Coils 3 – Read Holding Registers 4 – Read Input Registers 5 – Write to Coils 6 – Write to Holding Registers
RS485 Interface	2-wire plus 0Vdc. Screen terminated to controller chassis. Termination resistors - 120Ω, set by jumper link.
Isolation	50Vdc

7.2 MODbus TCPIP

Protocol	Modbus TCP. Modbus Functions supported: 1 – Read Coils 2 - Read Discrete Inputs 3 – Read Holding Registers 4 – Read Input Registers 5 – Write to Coils 6 – Write to Holding Registers
Ethernet Interface	10 / 100Mbit, Isolated.

7.3 BACNET IP

Protocol	BACnet IP. BACnet Object Types supported: 1 – Analog Input 2 - Analog Output 3 – Analog Value 4 – Binary Output 5 – Device
Ethernet Interface	10 / 100Mbit, Isolated.

8. Appendix - Communications

8.1 E110 Flame Monitor.

SETUP

Each E110 connected to the MODBUS communication bus must have a unique address. This is set using the ED510 display module. Scroll to PROGRAM SETUP, enter this sub-menu, scroll to UNIT ADDRESS, press and release the RESET key to obtain the desired address.

COMMUNICATIONS

The protocol to be used is MODBUS RTU. This is implemented by the master (PC, PLC, etc.) issuing a poll to the slave (Flame-Monitor) and the slave responding with the appropriate message.

A typical format of a poll request is as follows:

DST	FNC	ADR HI	ADR LO	DAT HI	DAT LO	CRC LO	CRC HI

DST refers to the logical address of the slave.
FNC is the function being requested. FNC 03 is a read request.
ADR is the message number or register number of the data being requested. In MODBUS, register addresses begin at 40001 but is interpreted as address 00.
DAT is the number of words being requested. A word is an integer consisting of 2 bytes.
The normal response from a slave is as follows:

DST	FNC	DBC	DATA….	CRC	CRC
			Hi/Lo	LO	HI

DBC is the data byte count being returned. It must be two times the DAT number from the poll request. DATA is the data returned and is always a series of 2 byte integers. If 4 words were requested then DBC would be 8 and there would be 8 data bytes or 4 data words containing the requested data.

The format of the data is 4800,N,8,1 meaning 4800 baud, no parity, and 1 stop bit.

Below is a table of currently available messages provided by the Flame-Monitor programmers, followed by a description where necessary, EP engineering code 38 or greater and EPD engineering code 4 or greater.

Table 12: MODBUS MESSAGE TABLE - Holding registers (4XXX(X)

MESSAGE ADDRESS	WORD REQUESTED	RESPONSE	VALUE
00	1-6	STATUS	83 (053H) = RUN; 202 (0CAH) = LOCKOUT
01	1	MSGN	Current message being displayed (see Table 15 on page 57)
02	1	GSTAT	Defines Timer Type
03	1	TIMER	Time, Flame, Address
04	1	FLAME	Flame Signal
05	1-3	LOGSTAT	Current logic module, PURGE, PTFI, AUTO (See Table 14 on page 56)
06	1	INPUTS	Input limits state
07	1	OUTPUTS	Output relays state
08	2	SYSMINS	System on minutes
10	2	BNRMINS	Burner on minutes
12	2	CYCLES	Completed Burner Cycles
14	1	LOCKOUT COUNT	Stored Lockout Count
15	1-6	LOCKOUT HISTORY	Last 6 Lockouts, first word is most current lockout
21	1-2	DEVTYP	Programmer device type, 5=EP, 6=EPD, 7=MicroM
22	1	AMPTYP	Amplifier Type; EUVS4=0C0H; EIR1=0A0H; ERT1, EUV1=090H;
23			
24	2	FLAME SIGNAL AVERAGES	PTFI and Auto Flame Signal Averages

MESSAGE ADDRESS	WORD REQUESTED	RESPONSE	VALUE
35	6	Most Recent Lockout Data	Returns complete lockout description of stored lockout history. Includes lockout message, lockout module, @ burner hours, and @
41	6	2nd Most Recent Lockout Data	
47	6	3rd Most Recent Lockout Data	
53	6	4th Most Recent Lockout Data	
59	6	5th Most Recent Lockout Data	
65	6	6th Most Recent Lockout Data	
71	1-3	Input limits and Expansion Module registers	Returns input limits state and lower and upper expansion module (E300) registers. (See Table 13 on page 55)
72	1-2	Expansion Module (E300) registers	Returns lower and upper Expansion Module registers
73	1		Return only upper Expansion Module register

It is suggested that polling intervals not be less than 200 mSec per request. Requesting data such as burner minutes, system minutes and burner cycles should be kept at a minimum due to the amount of processing time required to gather that data.

Messages 00, 05, 08, 10, 15, 21 and 26 are unique in that a limited number of successive registers can be combined with these requests. For example, a request to message 00 can contain up to 6 data words. The response to this would contain STATUS, MSGN, GSTAT, TIMER, FLAME and LOGSTAT. If the requested data word count (DAT) were to be 2 then the response would contain STATUS and MSGN only. Message 15, last 6 lockouts, can return data ranging from 1 to 6, with 1 referring to the most recent lockout.

The MSGN being transmitted is a numerical value and must be interpreted by the communicating device, which actually is an advantage since this can be made to be whatever message text the end user wants. In other words, it allows for programming custom messages without actually changing the message in the programmer. Refer to Table 15 on page 57 for message information.

The Flame-Monitor stores its burner on time and system on time (L1 powered) in minutes. For display purposes, the programmer converts this to hours. The information being supplied by MODBUS will be the actual time in minutes and it is up to the communicating device to do the conversion. Since the maximum value stored in the Flame-Monitor is 9,999,999 minutes, the maximum value in hex therefore is 98967FH and comprises two data words. The maximum cycle count is 999,999 decimal or F423FH, still two data words. As an example, the System on Minutes data is transmitted from the Flame-Monitor to the interface as high word / low word as shown below

ADDRESS 8		ADDRESS 9		
HIGH		LOW		
HIGH BYTE	LOW BYTE	HIGH BYTE	W RD	LOW BYTE
0	98H	97H		FH

Note: Data from address 9 cannot be accessed directly.

All values are represented in a HEX or base 16 format.

GSTAT determines the type of value TIMER represents. TIMER can be a running timer such as is used in purge, a flame signal or meaningless. Only the lower nibble of GSTAT has any value. If this value is 0 then the TIMER value has no meaning. The value in TIMER is a background minute timer in the Flame-Monitor and should be ignored. If GSTAT is between 4 and 7, the TIMER represents the current value flame signal. If GSTAT is a 1, 2, or 3 then TIMER represents a running timer value.

The baud rate of the Flame-Monitor is fixed at 4800 bits per second. The format of the data is 8 data bits, no parity and 1 stop bit. Due to the RS485 format, the communication format is considered half- duplex. That is, only one user is permitted on the communication lines at a time.

The information contained in INPUTS and OUTPUTS represents the status of the interlocks and relays respectively. For the INPUTS, a 1 in the interlock position defines the interlock as being on or active where a 1 in any bit position in the OUTPUT register signifies the relay as being energized.

- Refer to Fireye bulletin E-3001 for terminal designations

Table 13: INPUTS

Bit 7 Term P	Term 5/6	Term D		Term 8	Term 7	Term 3	bit 0 Term 13
Air Flow	Ignition	Low Fire	Ref	High Fire	Main Fuel	FVES or POC	Op Ctrl

A '1' in the opto-coupler position indicates the opto-coupler is on or interlock closed.

EXPANSION MODULE (E300) LOWER - REFER TO BULLETIN E-3001

Term 35	Term 34	Term 33	Term 32	Term 23	Term 22	Term 21	Term 20
Aux #6	Aux #5	Aux #4	High Temp	High Water	AUX #2	AUX #1	Op Ctrl

EXPANSION MODULE (E300) UPPER - REFER TO BULLETIN E-3001

Term 31	Term 30	Term 29	Term 28	Term 27	Term 26	Term 25	Term 24
High Pressure	Low Gas Pressure or Low Atomizing Media	Low Oil Temp.	Low Oil Pressure	High Gas Pressure	Oil Selected	Gas Selected	Low Water

OUTPUTS

Term 11	Term M	Term 6		Term 5	Term 7	Term A	Term X
Auto (RA1)	Blower (RB)	Ignition (RA2)	FVES (RV)	Pilot (RP)	Main Fuel (RF)	Alarm (RL)	High Fire (RH)

LOGSTAT is an indication of what logic module the control is currently in during its operating sequence and is used for diagnostic purposes only. The message displayed corresponds to the current logic module. The range of values are 4EH for Standby, 45H for PostIdle through 4DH for Shut down 2. Note that the above values are represented in hexadecimal format.

EXPLANATION OF LOGSTAT IN E110 STSTEMS

Table 14:

LOGIC DISPATCHER			
VALUE		MODULE	FUNCTION
DEC	HEX		
69	45H	MPOSTIDLE	
70	46H	MPREPURGE1	Wait for air flow and/or high fire switch to close
71	47H	MPURGE	Open Damper Purge
72	48H	MPOST PURGE	Low Fire Purge
73	49H	MTFI	Pilot Trial
74	4AH	MTFMF	Main Trial
75	4BH	MAUTO	AUTO
76	4CH	MSHTDWN1	Post Purge
77	4DH	MSHTDWN2	Post Purge
78	4EH	MIDLE	Standby

Logstat represents the current software module the Flame-Monitor is currently executing. They are named as close to the logic module the actual burner sequence is in. For instance, in the Flame-Monitor, MPURGE represents High Fire Purge where MPOSTPURGE represents the low fire start period where the mod motor is sent to the low fire position in preparation for pilot light-off. MSHUTDWN1 represents the post purge period after a complete cycle or the cool down period after a lockout.

MIDLE or STANDBY is the period of time where the operating control is open or the control is in lockout waiting for reset. On instances of false flame during the purge period, the control algorithm forces the control back to STANDBY until false flame ceases or lockout occurs.

MPREPURGE1 is the period of time prior to PURGE where the control checks the status of the air flow interlocks or the high fire proving switch (D-8). If either switch is found open, the control will remain in this state until the respective switch closes or lockout occurs.

MTFI represents the pilot trial for ignition stage of a burner sequence. MTFMF represents the main trial for main flame period where main fuel is introduced along with pilot and igniter.

MAUTO is the run period of the burner sequence.

MPOSTIDLE and MSHTDWN2 are small periods of time where certain internal tests are conducted and general cleanup before and after a cycle is performed.

The Flame-Monitor outputs the current displayed message as well as the historical lockout messages as numbers. The table that follows correlates the message number with the actual displayed test message.

Table 15: Message Table

DEC	HEX		TYPE AND MESSAGES
			E110 FLAME-MONITOR MESSAGES
1	1	R	L1-13 OPEN
2	2	H	HOLD FALSE FLAME- STANDBY
3	3	R	LOW FIRE PURGE
4	4	H	HOLD D-8 LIMIT OPEN- PURGE
5	5	H	HOLD 3-P AIR FLOW OPEN
6	6	L	LOCKOUT LINE FREQUENCY NOISE DETECTED
7	7	L	LOCKOUT FLAME FAIL - PTFI
8	8	C	CHECK UNIT ADDRESS
9	9	H	HOLD M-D LIMIT OPEN
10	A	R	IGNITION TIMING - PTFI
11	B		
12	C	R	FLAME SIGNAL - AUTO
13	D	R	CYCLE COMPLETE - POST PURGE
14	E	R	L1-13 OPEN (AFTER 2 MINUTES)
15	F	L	LOCKOUT AC POWER FAIL (EP165, EP166)
16	10	L	LOCKOUT SHORT CIRCUIT TERMINAL 5, 6 or 7
17	11	L	LOCKOUT D-8 LIMIT OPEN
18	12	L	LOCKOUT M-D LIMIT OPEN
19	13	L	LOCKOUT FLAME FAIL - MTFI
20	14	L	LOCKOUT FALSE FLAME
21	15	L	LOCKOUT 3-P INTLK OPEN (PURGE)
22	16	L	LOCKOUT 3-P INTLK CLOSED
23	17	H	HOLD 3-P INTLK CLOSED
24	18	H	HIGH FIRE PURGE
25	19	R	PLEASE WAIT (INITIALIZING)
26	1A	L	LOCKOUT 3-P INTLK OPEN -AUTO
27	1B	L	LOCKOUT 3-P INTLK OPEN (MTFI)
28	1C	L	LOCKOUT 3-P INTLK OPEN (PTFI)
29	1D	L	LOCKOUT 13-3 FVES OPEN
30	1E		
31	1F	C	CHECK FLAME SIGNAL - PTFI
32	20	C	CHECK D-8 HI LIMIT
33	21	C	CHECK M-D LOW LIMIT (CHECK)
34	22	R	FLAME SIGNAL- PTFI
35	23	C	CHECK LOW FIRE SIGNAL
36	24	R	FLAME SIGNAL - MTFI
37	25	L	LOCKOUT FLAME FAIL (AUTO)
38	26	H	HOLD 3-P INTLK OPEN - PURGE
39	27	L	LOCKOUT FUEL VALVE STATE CHANGE
			E300 EXPANSION MODULE LOCKOUT MESSAGES
40	28	L	3-P AIR FLOW OPEN
41	29	L	3-P HIGH WATER
42	2A	L	3-P LOW WATER
43	2B	L	3-P HIGH GAS PRESSURE
44	2C	L	3-P LOW GAS PRESSURE
45	2D	L	3-P LOW OIL PRESSURE
46	2E	L	3-P LOW OIL TEMPERATURE
47	2F	L	3-P LOW ATOMIZING MEDIA
48	30	L	3-P HIGH STEAM PRESSURE

DEC	HEX		TYPE AND MESSAGES
49	31	L	3-P HIGH TEMPERATURE
50	32	L	3-P AUX #4 OPEN
51	33	L	3-P AUX #5 OPEN
52	34	L	3-P AUX #6 OPEN
53	35	L	3-P FUEL SELECT
SYSTEM DIAGNOSTIC MESSAGES			
54	36	L	LOCKOUT CHECK CHASSIS
55	37	L	LOCKOUT CHECK PROGRAMMER
56	38	L	LOCKOUT CHECK AMPLIFIER
57	39	L	LOCKOUT CHECK EXPANSION MODULE
58	3A	L	LOCKOUT AMPLIFIER AUTO CHECK FAIL
59	3B	L	LOCKOUT SCANNER NOISE
76	4C	L	LOCKOUT CHECK SCANNER
E300 EXPANSION MODULE HOLD MESSAGES			
60	3C	H	L1-13 AUX #1 OPEN (TERMINAL 20)
61	3D	H	L1-13 AUX #2 OPEN (TERMINAL 21)
62	3E	H	L1-13 AUX #3 OPEN (TERMINAL 22)
63	3F	H	3-P HIGH WATER (TERMINAL 23)
64	40	H	3-P LOW WATER (TERMINAL 24)
65	41	H	3-P HIGH GAS PRESSURE
66	42	H	3-P LOW GAS PRESSURE
67	43	H	3-P LOW OIL PRESSURE
68	44	H	3-P LOW OIL TEMPERATURE
69	45	H	3-P LOW ATOMIZING MEDIA
70	46	H	3-P HIGH PRESSURE (TERMINAL 31)
71	47	H	3-P HIGH TEMPERATURE (TERMINAL 32)
72	48	H	3-P AUX #4 OPEN (TERMINAL 33)
73	49	H	3-P AUX #5 OPEN (TERMINAL 34)
74	4A	H	3-P AUX #6 OPEN (TERMINAL 35)
75	4B	H	3-P FUEL SELECT
PURGE INTERLOCK RELATED MESSAGES			
76	4C	L	LOCKOUT CHECK SCANNER
77	4D	H	HOLD D-8 LIMIT CLOSED
78	4E	L	LOCKOUT D-8 LIMIT CLOSED
79	4F	H	HOLD M-D LIMIT CLOSED
80	50	L	LOCKOUT M-D LIMIT CLOSED
81	51	L	LOCKOUT 13-3 POC CLOSED (CB ONLY)
82	52	R	DYNAMIC CHECK (CB ONLY)

R = Run

H = Hold

C = Check

L = Lockout

8.2 YB110 BurnerLogix.

SETUP

Each YB110 connected to the MODBUS communication bus must have a unique address. This is set using the BLV512 or BLL510 display module. Scroll to PROGRAM SETUP, enter this sub-menu, scroll to UNIT ADDRESS, press the RESET/MODIFY key, press the NEXT or BACK key to obtain the desired address, and RESET/MODIFY key to save the selection

COMMUNICATIONS

The protocol to be used is MODBUS RTU. This is implemented by the master (PC, PLC, etc.) issuing a poll to the slave (BurnerLogix) and the slave responding with the appropriate message.

A typical format of a poll request is as follows:

MESSAGE FORMAT

DST	FNC	ADR	ADR	DAT	DAT	CRC	CRC
		HI	LO	HI	LO	LO	HI

DST refers to the logical address of the slave.

FNC is the function being requested. FNC 03 is a read request.

ADR is the message number or register number of the data being requested.

For the BurnerLogix all registers are mapped as HOLDING REGISTERS, FNC 03. Register addresses begin at 40001 but is interpreted as address 00.

DAT is the number of words being requested. A word is an integer consisting of

2 bytes. The normal response from a slave is as follows:

DST	FNC	DBC	DATA….	CRC	CRC
			Hi/Lo	LO	HI

DBC is the data byte count being returned. It must be two times the DAT number from the poll request.

DATA is the data returned and is always a series of 2 byte integers. If 4 words were requested then
DBC would be 8 and there would be 8 data bytes or 4 data words containing the requested data.

The format of the data is N,8,1 meaning no parity, and 1 stop bit. Baud rate is selectable through the keypad / display. As shipped the baud rate is 9600.

Communication to the BurnerLogix control is made through either of the RJ-12 jacks located on the underside of the control (note figure on right). The jacks are internally wired in parallel to ease multi-dropping of BurnerLogix controls. For each of the RJ-

12 connections, the outside contacts are connected together and are designated as “A” or “+” while the inside contacts are connected together and are designated as “B” or “-”. Fireye supplies the ED512 cables in various lengths with RJ-12 plugs on each end. Refer to bulletin E-8002 for additional information.

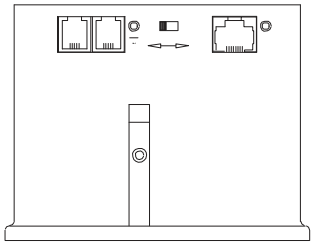


Table 16: MODBUS MESSAGE TABLE - HOLDING REGISTERS (4XXX(X))

HOLDING REGISTER	MESSAGE ADDRESS	WORD REQUESTED	WORD RESPONSE	VALUE
40001	00	1	STATUS	83 (053H) = RUN; 202 (0CAH) = LOCKOUT
40002	01	1	MSGN	Current message being displayed (see Table 21 on page 64)
40003	02	1	GSTAT	Defines Timer Type
40004	03	1	TIMER	Time in seconds
40005	04	1	FLAME	Flame Signal
40006	05	1	LOGSTAT	Current logic module, PURGE, PTFI, AUTO (see Table 20 on page 63)
40007	06	1	INPUTS	Input limits state
40008	07	1	OUTPUTS	Output relays state
40009	08	2	SYSMINS	System on minutes
40011	10	2	BNRMINS	Burner on minutes
40013	12	2	CYCLES	Completed Burner Cycles
40015	14	1	LOCKOUT COUNT	Stored Lockout Count
40016	15	6	LOCKOUT ISTORY Most Recent Lockout data	Beginning of Last 10 Lockouts
40022	21	6	2nd Most Recent Lockout Data	Returns complete lockout description of stored lockout history. Includes lockout message (1), lockout module (1), @ burner hours (2), and @ burner cycles (2)s
40028	27	6	3rd Most Recent Lockout Data	
40034	33	6	4th Most Recent Lockout Data	
40040	39	6	5th Most Recent Lockout Data	
40046	45	6	6th Most Recent Lockout Data	
40052	51	6	7th Most Recent Lockout Data	
40058	57	6	8th Most Recent Lockout Data	
40064	63	6	9th Most Recent Lockout Data	
40070	69	6	10th Most Recent Lockout Data	
40076 - - -	75 - - -	4		
40080 - - -	79 - - -	11	N/A	Reserved for Fireye use
INTERLOCK ANNUNCIATOR				
40901	900	1 - 3	YZ300 Expansion Module registers (see Table 19 on page 62)	Returns lower, middle and upper interlock annunciator (YZ300) registers.
40902	901	1 - 2		Returns middle and upper interlock annunciator (YZ300) registers.
40903	902	1		Returns upper interlock annunciator (YZ300) register.

It is suggested that polling intervals not be less than 200 mSec per request. Requesting data such as burner minutes, system minutes and burner cycles should be kept at a minimum due to the amount of processing time required to gather that data.

The MSGN being transmitted is a numerical value and must be interpreted by the communicating device, which actually is an advantage since this can be made to be whatever message text the end user wants. In other words, it allows for programming custom messages without actually changing the message in the programmer. Refer to Table 21 on page 64, for message information.

The BurnerLogix stores its burner on time (7 powered) and system on time (L1 powered) in minutes. For display purposes, the programmer converts this to hours. The information being supplied by MODBUS will be the actual time in minutes and it is up to the communicating device to do the conversion. Since the maximum value stored in the BurnerLogix is 9,999,999 minutes, the maximum value in hex therefore is 98967FH and comprises two data words. The maximum cycle count is 999,999 decimal or F423FH, still two data words.

*To convert, multiply high word by 10000H (65536), add to this high byte of low word multiplied by 100H (256) and add to this the low byte of low word. Example: (98H*100H) + (96H*10000H) + 7FH = 98967FH = 9,999,999 minutes.*

As an example, the System on Minutes data is transmitted from the BurnerLogix to the interface as high word / low word as shown below: The same applies to Burner On Minutes and Burner Cycles.

ADDRESS 8		ADDRESS 9	
HIGH WORD		LOW WORD	
HIGH BYTE	LOW BYTE	HIGH BYTE	LOW BYTE
0	98H	96H	7FH

All values are represented in a HEX or base 16 format.

GSTAT determines the type of value TIMER represents. TIMER can be a running timer such as is used in purge, a flame signal or meaningless. Only the lower nibble of GSTAT has any value. If this value is 0 then the TIMER value has no meaning. The value in TIMER is a background minute timer in the BurnerLogix and should be ignored. If GSTAT is between 4 and 7, the TIMER represents the current value flame signal. If GSTAT is a 1, 2, or 3 then TIMER represents a running timer value.

The format of the data is 8 data bits, no parity and 1 stop bit. Due to the RS485 format, the communication format is considered half-duplex. That is, only one user is permitted on the communication lines at a time.

The information contained in INPUTS and OUTPUTS represents the status of the interlocks and output relays respectively. For the INPUTS, a 1 in the interlock position defines the interlock as being on or active where a 1 in any bit position in the OUTPUT register signifies the relay as being energized.

Table 17: INPUTS (40007)

Bit 15							Bit 8
AC Line	Term D	Term 16	Term 13	Term 21	Term 22	Term 23	Term 8
Ref	Low Fire Start	Pilot Hold	FVES POC	Start Input	Remote Reset	Spare	Purge Damper

Bit 7							Bit 0
Term P	Term 3	Term M	Term 5	Term 6	Term W	Term 7	KS
Run Interlock	Op Cntrl	Blower	Ignition	Pilot Valve	Delayed Valve	Main Valve	Safety Relay

A '1' in the opto-coupler position indicates the opto-coupler is on or interlock closed.

Table 18: **OUTPUTS (4008)**

Bit 15				Bit 11			Bit 8
				Term A	Term11	Term X	Term 12
				Alarm	Auto	High Fire	Low Fire

Bit 7				Bit 3			Bit 0
	IS	Term W	Term 7	Term M	Term 6	Term 5	
	Internal Safety	Delayed Valve	Main Valve	Blower	Pilot Valve	Ignition	

Note: A "1" in any bit position indicates the output or terminal is on or active.

Table 19:

YZ300 LOWER (40901) - REFER TO BULLETIN YZEM-3001

Bit 7							Bit 0
Term 47	Term 46	Term 44*	Term 43	Term 3	Term 42	Term 41	Term 40
Low Oil Temp	High Oil Temp	Low Water	High Water	Aux #3	Aux #2	Aux #1	Op Control

* Terminals 44 and 45 are internally connected

YZ300 MIDDLE (40902) - REFER TO BULLETIN YZEM-3001

Bit 7							Bit 0
Term 57	Term 56	Term 55	Term 54*	Term 52	Term 51	Term 49*	Term 48
Aux #4	High Temp	High Pressure	Aux Gas	High Gas Pressure	Low Gas Pressure	Low Atomizing	Low Oil Pressure

* Terminals 49 and 50 are internally connected
* Terminals 53 and 54 are internally connected

YZ300 UPPER (40903) - REFER TO BULLETIN YZEM-3001

Bit 7							Bit 0
				Term P	Term 60	Term 59	Term 58
Unused	Unused	Unused	Unused	Air Flow	Aux #7	Aux #6	Aux #5

* Unused Bits 4-7 will always return 0

EXPLANATION OF LOGSTAT IN YB110 SYSTEMS

LOGSTAT is an indication of what logic module the control is currently operating in during its cycle and is used for diagnostic purposes only. If a lockout occurs the current value of LOGSTAT is stored as part of the lockout information. The message displayed corresponds to the current logic module.

Table 20:

LOGIC DISPATCHER			
VALUE		MODULE	FUNCTION
DEC	HEX		
1	01H	STANDBY	Idle state
2	02H	BLOWER ON	1/2 second period after operating control closes when blower motor is energized
3	03H	PURGE	Open Damper Purge or waiting for air flow and/or high fire switch to close
4	04H	PURGE	Low Fire Purge
5	05H	PTFI	Pilot Trial for Ignition
6	06H	PTFI	Pilot Trial for Ignition for YP3XX programmers
7	07H	PTFI	If PTFI is greater than 5 seconds and early spark termination is not needed
8	08H	PTFI	If PTFI is greater than 5 seconds and early spark termination is needed
9	09H	PILOT	Pilot Hold, YP138 only
10	0AH	MTFI	Main Trial for Ignition
11	0BH	MTFI	Main Trial for Ignition with terminal 5 de-energized
12	0CH	AUTO	Delayed valve on
13	0DH	AUTO	AUTO
14	0EH	AUTO	On YP138 programmer, hold for 20 seconds with terminals 6 and 7 energized
15	0FH	AUTO	On YP138 programmer, when terminal 21 first energized, wait for M-D to close
16	10H	POSTPURGE	Post Purge
17	11H	POSTPURGE	Post Purge period if flame fail lockout
18	12H	POSTPURGE	Idle state if unit is in lockout

Logstat represents the current software module the BurnerLogix is currently executing.

The BurnerLogix outputs the current displayed message as well as the historical lockout messages as numbers. The table below correlates the message number with the actual displayed text message.

Table 21: :

DEC	HEX		BURNERLOGIX MESSAGES
1	1	H	T16 M-D LIMIT OPEN - AUTO
2	2	H	HOLD FALSE FLAME- STANDBY
3	3	R	LOW FIRE PURGE
4	4	H	HOLD M-8 LIMIT OPEN- PURGE
5	5	H	See Interlock Annunciation Message Table
6	6	H	T16 M-D LOW LIMIT - AUTO
7	7	L	LOCKOUT FLAME FAIL - PTFI
8	8	H	T16 INPUT CLOSED
9	9	H	HOLD M-D LIMIT OPEN
10	A	R	IGNITION TIMING - PTFI
11	B	C	CHECK FLAME SIGNAL - MTFI
12	C	R	FLAME SIGNAL - AUTO
13	D	R	CYCLE COMPLETE - POST PURGE
14	E	R	L1-3 OPEN
15	F	H	T21 INPUT CLOSED
16	10	L	LOCKOUT M-D LIMIT OPEN - PTFI
17	11	L	LOCKOUT M-8 LIMIT OPEN
18	12	L	LOCKOUT M-D LIMIT OPEN
19	13	L	LOCKOUT FLAME FAIL - MTFI
20	14	L	LOCKOUT FALSE FLAME
21	15	L	LOCKOUT 3-P INTLK OPEN (PURGE)
22	16	L	LOCKOUT 3-P INTLK CLOSED
23	17	H	HOLD 3-P INTLK CLOSED - STANDBY
24	18	H	HIGH FIRE PURGE
25	19	L	LOCKOUT M-D LIMIT OPEN - MTFI
26	1A	L	LOCKOUT 3-P INTLK OPEN -AUTO
27	1B	L	LOCKOUT 3-P INTLK OPEN - MTFI
28	1C	L	LOCKOUT 3-P INTLK OPEN - PTFI
29	1D	L	LOCKOUT T13 FVES OPEN
30	1E	L	LOCKOUT 3-P INTLK OPEN - PREPURGE
31	1F	C	CHECK FLAME SIGNAL - PTFI
32	20	C	CHECK M-8 HI LIMIT (HI FIRE PURGE)
33	21	C	CHECK M-D LOW LIMIT (LO FIRE START)
34	22	R	FLAME SIGNAL- PTFI
35	23	C-H	HOLD T21 or CHECK LOW FIRE SIGNAL - AUTO
36	24	R	FLAME SIGNAL - MTFI
37	25	L	LOCKOUT FLAME FAIL (AUTO)
38	26	H	HOLD 3-P INTLK OPEN - PREPURGE
39	27	L	LOCKOUT FUEL VALVE STATE CHANGE
104	68	R	LEARNING FLAME (PTFI and AUTO)
SYSTEM DIAGNOSTIC MESSAGES			
54	36	L	LOCKOUT CHECK CHASSIS
55	37	L	LOCKOUT CHECK PROGRAMMER

DEC	HEX		BURNERLOGIX MESSAGES
56	38	L	See Interlock Annunciation Message Table
57	39	L	LOCKOUT CHECK EXPANSION MODULE
58	3A	L	LOCKOUT CHECK WIRING
59	3B	L	LOCKOUT CHECK FUSE
76	4C	L	LOCKOUT CHECK SCANNER
PURGE INTERLOCK RELATED MESSAGES			
77	4D	H	HOLD M-8 LIMIT CLOSED
78	4E	L	LOCKOUT M-8 LIMIT CLOSED
79	4F	H	HOLD M-D LIMIT CLOSED
80	50	L	LOCKOUT M-D LIMIT CLOSED
81	51		Reserved for future use
82	52		Reserved for future use
83	53	L	LOCKOUT FLAME FAIL - PILOT
84	54	L	LOCKOUT 3-P INTLK OPEN - PILOT
85	55	L	LOCKOUT M-D LIMIT OPEN - PILOT
86	56	L	LOCKOUT T13 FVES OPEN - PILOT
87	57	L	LOCKOUT T13 FVES OPEN - POST PURGE

Table 22:

DEC	HEX	STATE	TERMINAL	YZ300 INTERLOCK ANNUNCIATOR LOCKOUT MESSAGES
41	29	L	3-43	HIGH WATER
42	2A	L	43-44	LOW WATER
43	2B	L	51-52	HIGH GAS PRESSURE
44	2C	L	50-51	LOW GAS PRESSURE
92	5C	L	52-54	AUX GAS
45	2D	L	47-48	LOW OIL PRESSURE
56	38	L	44-46	HIGH OIL PRESSURE
46	2E	L	46-47	LOW OIL TEMPERATURE
47	2F	L	48-50	LOW ATOMIZING MEDIA
48	30	L	54-55	HIGH PRESSURE
49	31	L	54-55	HIGH TEMPERATURE
50	32	L	56-57	AUX #4 OPEN
51	33	L	57-58	AUX #5 OPEN
52	34	L	58-59	AUX #6 OPEN
53	35	L	59-60	AUX #7 OPEN
40	28	L	60-P	AIR FLOW OPEN

Table 23:

INTERLOCK ANNUNCIATOR				
DEC	HEX	STATE	TERMINAL	YZ300 INTERLOCK ANNUNCIATOR HOLD MESSAGES
94	5E	H	L1-40	OP CONTROL OPEN
60	3C	H	40-41	L1-3 AUX #1 OPEN
61	3D	H	41-42	L1-3 AUX #2 OPEN
62	3E	H	42-3	L1-3 AUX #3 OPEN
63	3F	H-C	3-43	HIGH WATER
64	40	H-C	43-44	LOW WATER
65	41	H-C	51-52	HIGH GAS PRESSURE
66	42	H-C	50-51	LOW GAS PRESSURE
95	5F	H-C	52-54	AUX GAS
67	43	H-C	47-48	LOW OIL PRESSURE
96	60	H-C	44-46	HIGH OIL TEMPERATURE
68	44	H-C	46-47	LOW OIL TEMPERATURE
69	45	H-C	48-50	LOW ATOMIZING MEDIA
70	46	H-C	54-55	HIGH PRESSURE
71	47	H-C	55-56	HIGH TEMPERATURE
72	48	H-C	56-57	AUX #4 OPEN
73	49	H-C	57-58	AUX #5 OPEN
74	4A	H-C	58-58	AUX #6 OPEN
75	4B	H-C	59-60	AUX #7 OPEN
5	5	H-C	60-P	AIR FLOW OPEN

R = RUN H = HOLD L = LOCKOUT C = CHECK

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