

# **Technical Information Manual**

Revision n. 3  
20 December 2002

**MOD. N568 B**  
**MOD. N568 LC**

*16 CHANNEL*  
*Spectroscopy Amplifiers*

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# TABLE OF CONTENTS

<b>1. DESCRIPTION.....</b>	<b>6</b>
1.1 FUNCTIONAL DESCRIPTION .....	6
<b>2. SPECIFICATIONS .....</b>	<b>8</b>
2.1 EXTERNAL COMPONENTS .....	8
2.2 CHARACTERISTICS OF THE SIGNALS .....	9
2.3 POWER REQUIREMENTS.....	10
<b>3. OPERATING MODES.....</b>	<b>12</b>
3.1 GENERAL INFORMATION .....	12
3.2 MODULE OPERATION.....	12
3.2.1 <i>MANUAL SETTINGS</i> .....	12
3.2.2 <i>OUTPUT CONFIGURATION SETTING</i> .....	12
3.2.3 <i>OUTPUT POLARITY SETTING</i> .....	13
3.2.4 <i>SHAPE SETTING</i> .....	13
3.2.5 <i>GAIN SETTING</i> .....	14
3.2.6 <i>POLE ZERO ADJUSTMENT</i> .....	14
3.2.7 <i>OFFSET SETTING</i> .....	14
3.3 H. S. CAENET .....	15
<b>4. H. S. CAENET OPERATION .....</b>	<b>16</b>
4.1 USING THE H. S. CAENET MANUAL CONTROLLER.....	16
4.2 USING THE H. S. CAENET VME CONTROLLER .....	18
4.2.1 <i>Master to Slave data composition (V288 case)</i> .....	19
4.2.2 <i>Slave to Master data composition (V288 case)</i> .....	19
4.3 USING THE H. S. CAENET CAMAC CONTROLLER.....	20
4.3.1 <i>Master to Slave data composition (C117B case)</i> .....	21
4.3.2 <i>Slave to Master data composition (C117B case)</i> .....	21
4.3.3 <i>MASTER TO SLAVE OPERATING CODES (CAMAC and VME)</i> .....	22
4.4 SET VALUES .....	22
4.5 SLAVE TO MASTER DATA PACKET DESCRIPTION (CAMAC AND VME).....	24
4.5.1 <i>Error Codes description</i> .....	25
4.5.2 <i>Module Identifier Packet (response to code %0)</i> .....	26
4.6 USING THE H. S. CAENET PC CONTROLLERS .....	26

4.7	BOARD CONTROL VIA OPC SERVER .....	27
4.7.1	<i>N568B / N568LC board control</i> .....	27
4.7.2	<i>N568B / N568LC channel control</i> .....	29
4.8	DATA COMPOSITION (PC CONTROLLER CASE).....	31
4.8.1	<i>Master to Slave Data Composition (PC Controller Case)</i> .....	31
4.8.2	<i>Slave to Master Data Composition (PC Controller Case)</i> .....	32
4.9	MASTER TO SLAVE OPERATING CODES (PC CONTROLLER CASE) .....	32
4.10	SET VALUES .....	33
4.11	SLAVE TO MASTER DATA PACKET DESCRIPTION (PC CONTROLLER CASE).....	34
4.11.1	<i>Error Codes description</i> .....	36
4.11.2	<i>Module Identifier Packet (response to code %0)</i> .....	36

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## ***LIST OF FIGURES***

FIG. 1.1:	N568B/LC BLOCK DIAGRAM.....	7
FIG. 1.2:	N568B/LC CHANNEL BLOCK DIAGRAM.....	7
FIG. 2.1:	MOD. N568B/LC FRONT PANEL.....	11
FIG. 3.1:	FOUT CONFIGURATION .....	13
FIG. 4.1:	MOD. N568B/LC STATUS REGISTER.....	24

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## ***LIST OF TABLES***

TABLE 3.1:	GAIN VALUES (SIGNALS RISE TIME: 10 $\mu$ S).....	14
TABLE 3.2:	GAIN VALUES (SIGNALS RISE TIME: 0.05 $\mu$ S).....	14
TABLE 4.1:	MOD. V288 REGISTERS .....	19
TABLE 4.2:	MASTER TO SLAVE DATA COMPOSITION (V288 CASE) .....	19
TABLE 4.3:	SLAVE TO MASTER DATA COMPOSITION (V288 CASE) .....	20
TABLE 4.4:	MOD. C 117 B CAMAC FUNCTIONS .....	20
TABLE 4.5:	MASTER TO SLAVE DATA COMPOSITION (C117B CASE).....	21
TABLE 4.6:	SLAVE TO MASTER DATA COMPOSITION (C117B CASE).....	21
TABLE 4.7:	OPERATING CODES OF THE N568B/LC (C117B AND V288 CASE).....	22
TABLE 4.8:	COARSE GAIN VALUES .....	23
TABLE 4.9:	SHAPE VALUES .....	23
TABLE 4.10:	ERROR CODES (C117B AND V288 CASE).....	25
TABLE 4.11:	MODULE IDENTIFIER DATA PACKET STRUCTURE.....	26

TABLE 4.12: HS CAENET PC CONTROLLERS REGISTERS.....	27
TABLE 4.13– N568B / N568LC BOARD ITEMS .....	28
TABLE 4.14– N568B / N58LC CHANNEL ITEMS .....	31
TABLE 4.15: MASTER TO SLAVE DATA COMPOSITION.....	32
TABLE 4.16: SLAVE TO MASTER DATA COMPOSITION.....	32
TABLE 4.17: OPERATING CODES OF THE N568B/LC .....	33
TABLE 4.18: COARSE GAIN VALUES .....	34
TABLE 4.19: SHAPE VALUES .....	34
TABLE 4.20: ERROR CODES .....	36
TABLE 4.21: MODULE IDENTIFIER DATA PACKET STRUCTURE.....	37

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# 1. DESCRIPTION

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## 1.1 FUNCTIONAL DESCRIPTION

The Model N 568 LC is a 16 CHANNEL SPECTROSCOPY AMPLIFIER implemented in a single-width NIM module. A "Low Noise"<sup>1</sup> version, the N568 B<sup>2</sup>, is also available.

It accepts the typical outputs generated from nuclear particle detectors connected with preamplifiers having an output signal pulse characterised by a fast rise time and a slow fall time. With 16 independent channels, this unit allows the optimization of cost and size in multi-detector systems.

For each channel the pole-zero cancellation (PZ), the shaping time, the amplification gain and the output inversion are remotely programmable (by CAMAC, VME, Standard PC or Manual Controller) via HIGH SPEED CAENET line.

The shaping time can be selected from 0.2  $\mu$ s to 6  $\mu$ s. The fine gain and coarse gain ranges allow a choice accuracy from 0.15 to 480. The working parameter values are automatically stored in a non-volatile memory. The inputs and the outputs of this module are accessible on the front panel.

A Gaussian Output is provided either with the programmed gain (OUT) or with a further 10x amplification (XOUT). The Gaussian Output can be set either as inverted or non-inverted.

A COMMON OFFSET can be programmed via CAENET and allows to shift the baseline of the output.

An FOUT output provides a fast amplification for timing purposes (fixed gain factor of 20). A "MUX O" and a "MUX F" output allow to monitor respectively the output and the fast output of a single channel selected via CAENET.

Two LEMO 00 connectors are foreseen for the CAENET line and a LED indicates the electrical condition of the CAENET network. When several modules are connected to the CAENET network, their identification is obtained by the thumb-wheel switches located on the front panel: up to 99 N 568 B/LC modules are controlled via 50  $\Omega$  coaxial cable at 1 MB transmission speed. Allowed controllers are the Manual Controller (Mod. A 250), the CAMAC (Mod. C 117 B), the VME (Mod. V 288) or the Standard PC (Mod. A 303, A303A and A1303) H. S. CAENET Controllers.

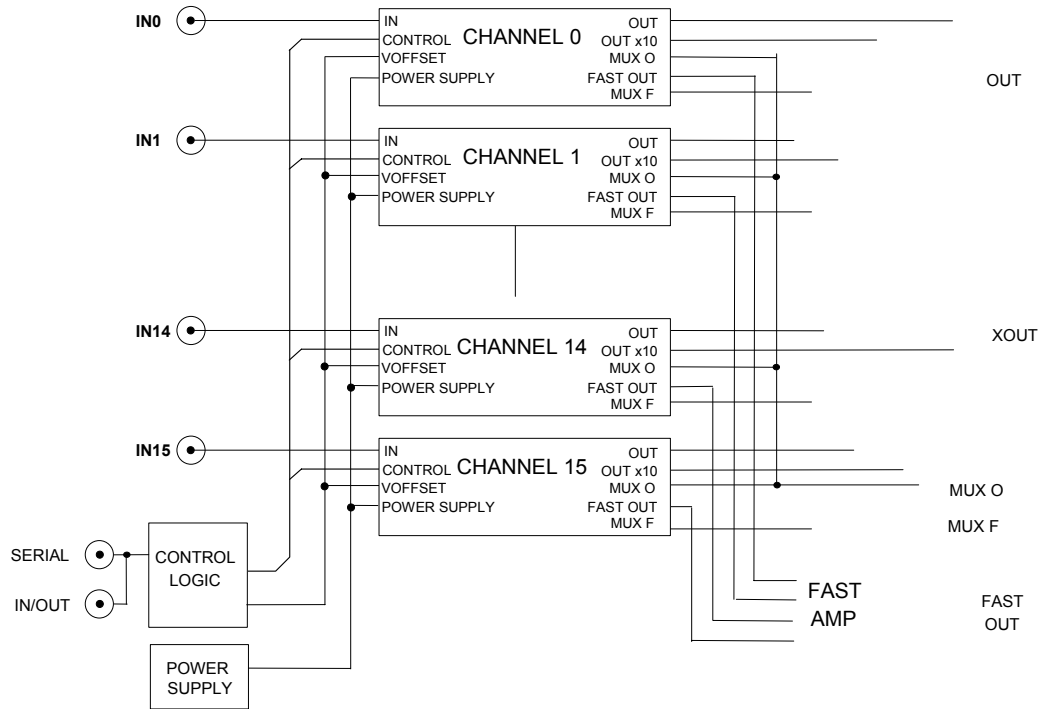
The communication between the Host computer system and the HIGH SPEED CAENET controller is performed via standard functions and cycles (CAMAC and VME systems) or via a standard memory or I/O mapped mode for a standard PC (for more detailed information see the relevant Technical Information Manual). The communication protocol and the meaning of the recognized command codes are always the same, independently from the used controller.

The performances of this module allow operation with scintillation detectors, proportional counters, semiconductor detectors in different applications.

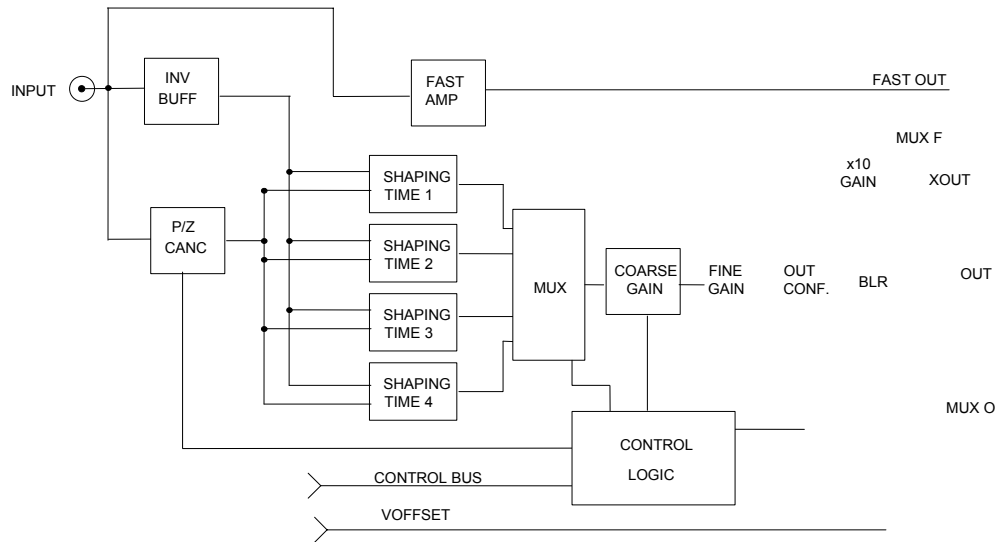
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<sup>1</sup> Equivalent input noise < 15  $\mu$ V RMS (Gain=100 and 3  $\mu$ s shaping time)

<sup>2</sup> Mod. N568 B Designed in collaboration with the I.N.F.N. MILANO



**Fig. 1.1: N568B/LC Block Diagram**



**Fig. 1.2: N568B/LC Channel Block Diagram**

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## 2. SPECIFICATIONS

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### 2.1 EXTERNAL COMPONENTS

#### CONNECTORS

- N. 16, "INPUTS 0..15", LEMO 00 type; input signal connectors.
- N. 1, "MUX O", LEMO 00 type; single selected channel output connector.
- N. 1, "MUX F", LEMO 00 type; single selected channel output connector.
- N. 1, "OUT 0..15", output connector, 17+17 pin, double row strip header (left pin: ground, right pin: signal).
- N. 1, "XOUT 0..15", output connector, 17+17 pin, double row strip header (left pin: ground, right pin: signal).
- N. 1, "FOUT 0..15", output connector, 17+17 pin, double row strip header (left pin: ground, right pin: signal).
- N. 2, "HIGH SPEED CAENET - SERIAL IN/OUT", LEMO 00 type, high impedance. Connectors for the HIGH SPEED CAENET operations.
- N. 1, "PWR MAN CTR", coaxial female plug, RCA type, to power the H. S. CAENET Manual Controller.

#### DISPLAYS

- N. 1, red LED, to indicate the activity of the H. S. CAENET node.

#### SWITCHES, TEST POINTS

- N. 1, "STATION NUMBER", Thumb-wheel switch selector, for the selection of the module identification (station number).
- N. 16, "INPUTS 0..15", input signal test points.



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## 2.2 CHARACTERISTICS OF THE SIGNALS

### INPUTS:

- INPUTS 0..15: Positive or negative pulses with rise time  $\geq 18$  ns, max. amplitude: 8 V (absolute value); 50  $\Omega$  impedance;
- H. S. CAENET IN/OUT: Std. CAENET protocol signals.

### OUTPUTS:

- OUT: 100  $\Omega$  impedance. Unipolar, dynamic range  $\pm 8$  V max; polarity as selected in common with XOUT and MUXOUT.
- XOUT: 100  $\Omega$  impedance. Unipolar, further 10x fixed amplification of the OUT value, dynamic range  $\pm 4$  V max into 100  $\Omega$  load; polarity as selected in common with OUT and MUXOUT.
- FOUT: 100  $\Omega$  impedance. Unipolar, 100 ns Differentiation Time Constant,  $\pm 4$  V max into 100  $\Omega$  load. Risetime: 25 ns typically. Gain factor: 7 to 10 for non inverting configuration, 20 to 30 (approx.) for inverting configuration.
- MUX O: 100  $\Omega$  impedance. Unipolar,  $\pm 8$  V max; polarity as selected in common with OUT. Selected channel is the last accessed via H.S. CAENET. Can be disabled via CAENET.
- MUX F: 100  $\Omega$  impedance. Unipolar, amplitude 85% approx. of FOUT amplitude. Selected channel is the last accessed via H.S. CAENET. Can be disabled via CAENET.
- PWR MAN CTR: Std. CAENET Manual Controller supply voltage.

### GENERAL:

- INTEGRAL NON LINEARITY:  $\pm 0.05\%$  in 90% of the full scale @ Gain=90 and 6  $\mu$ s shaping time ( $\pm 0.25\%$  typ. for any shaping time).
  - EQUIVALENT INPUT NOISE:
    - < 15  $\mu$ V (Gain=100; 3  $\mu$ s shaping time) (**Mod. N568 B**)
    - < 25  $\mu$ V (Gain=100; 3  $\mu$ s shaping time) (**Mod. N568 LC**)
- INTERCHANNEL CROSSTALK: Output in one OUT (FOUT) channel affects any other OUT (FOUT) channel by no more than -45 dB (at Gain =1 and 5 V input signal).
- GAIN RANGE: adjustable from 0.15 to 480 (see § 3.2.5).
- SHAPING TIME: selectable time constant of 0.2  $\mu$ s, 1  $\mu$ s, 3  $\mu$ s and 6  $\mu$ s.

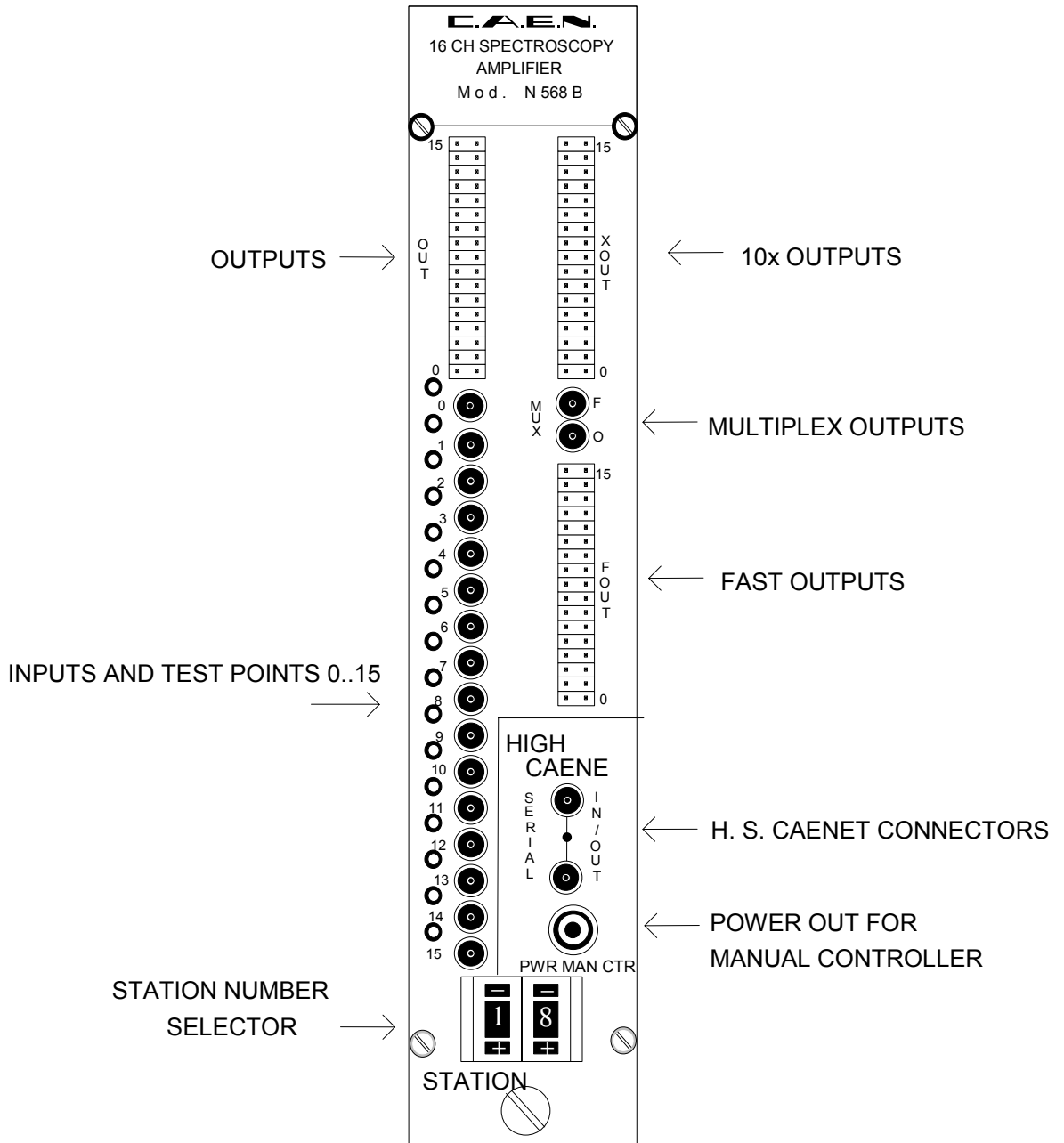
- COMMON OFFSET: from -75 mV to +210 mV with Positive Output Polarity; from +75 mV to -210 mV with Negative Output Polarity.

- POLE ZERO: adjustable on 256 steps to match preamp tails in a range from 50  $\mu$ s to 500  $\mu$ s.

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## 2.3 POWER REQUIREMENTS

+ 12 V	2300 mA	Maximum (inputs on all 16 channels)
- 12 V	1050 mA	
+ 6 V	750 mA	(1100 mA with A250 MAN. CONT. plugged in)



**Fig. 2.1: Mod. N568B/LC Front Panel**

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## 3. OPERATING MODES

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### 3.1 GENERAL INFORMATION

The Model N 568B/LC is a 16 CHANNEL SPECTROSCOPY AMPLIFIER implemented in a single-width NIM module.

Thanks to its high channel density, this unit allows the optimization of cost and size in multi-detector systems.

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### 3.2 MODULE OPERATION

At Power-ON, the module contains the last performed settings before Power-Off. The status of these settings can be read out via H.S. CAENET (see below).

The settings on each channel of the module can be performed in any order. Due to the logical dependence of certain settings from others, it is anyhow suggested to perform the first time User' settings on each channel of the module in the following order:

- a) set the output configuration (non-inverting or inverting);
- b) set the output polarity (positive or negative);
- c) set the shape;
- d) set the coarse gain;
- e) set the fine gain;
- f) set the pole-zero adjustment;
- g) set the offset;
- h) enable or disable the multiplexed output.

Once performed either first-time or ordinary settings, it is suggested, for best noise performances, NOT to access the module frequently via H.S. CAENET (e.g. for monitoring) while the module is operating on the final experimental setup.

The following paragraphs describe in more detail the single settings. Offset, Fine Gain and Pole-zero settings must be thought not as absolute settings, but as "digital trimmers" with which the User sets the desired parameters and controls the outputs obtained with well-known pulse shapes.

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#### 3.2.1 MANUAL SETTINGS

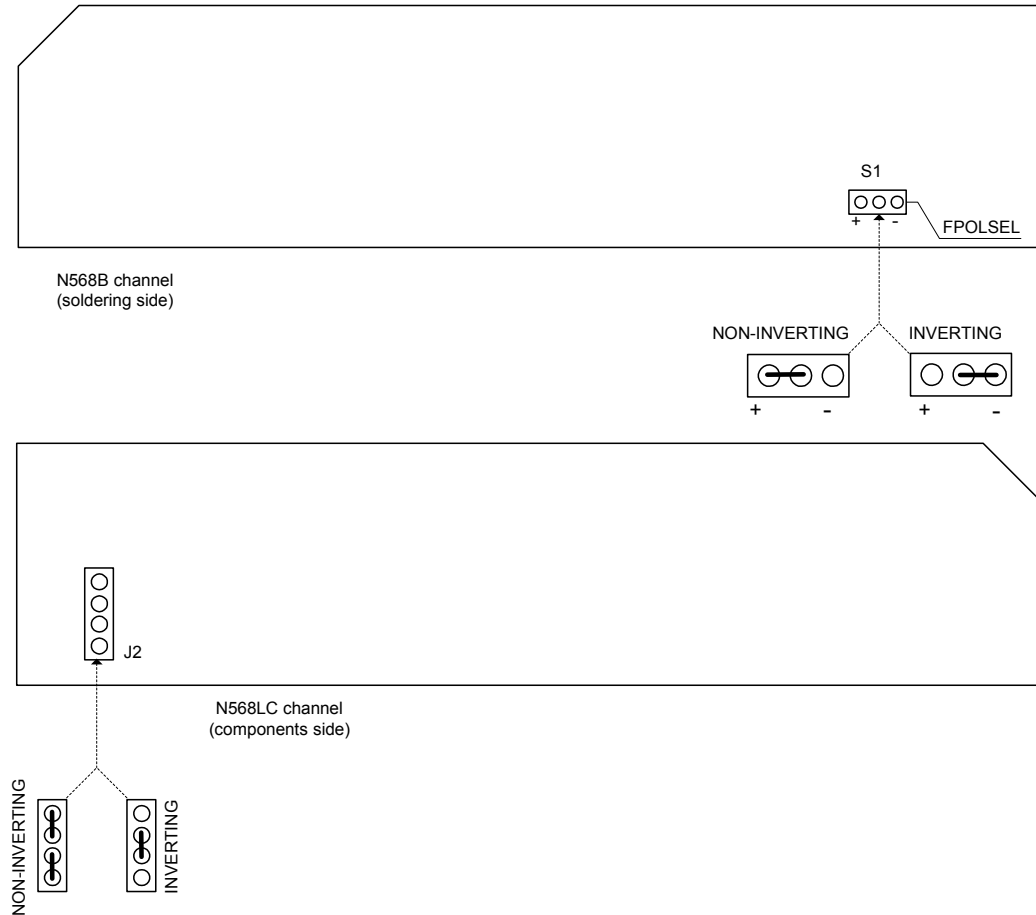
A two-digit thumb-wheel switch selects the module's Station Number for the CAENET operations.

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#### 3.2.2 OUTPUT CONFIGURATION SETTING

The OUT and XOUT configuration settings can be performed either via Manual Controller or via H. S. CAENET. They allow to select between DIRECT (NON-INVERTED) or INVERTED outputs. The

FOUT configuration can be selected between DIRECT (NON-INVERTED, factory setting) or INVERTED. The setting is performed via jumper for the N568 LC and by shortcircuiting two pins for the N568 B; refer to Fig. 3.1 for the components' location.



**Fig. 3.1: FOUT configuration**

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### 3.2.3 OUTPUT POLARITY SETTING

This setting can be done either via Manual Controller or via H. S. CAENET. It allows the internal electronics to operate at its best on the signals. It must be set according to the input signal polarity and the output configuration setting, e.g. if the input signal is Positive and the desired Output Configuration is chosen as Inverted, the output polarity is Negative and this information must be transferred to the module's internal electronics (optimization of the Baseline Restorer stage).

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### 3.2.4 SHAPE SETTING

This setting can be done either via Manual Controller or via H. S. CAENET. The shaping time can be selected in 4 steps (0 to 3) among the following: 0.2  $\mu$ s, 1  $\mu$ s, 3  $\mu$ s and 6  $\mu$ s.

### 3.2.5 GAIN SETTING

This setting can be done either via Manual Controller or via H. S. CAENET. The Coarse Gain can be set in 8 steps (0 to 7), each step approximately doubling the Gain of the previous one. The Fine Gain can be set in 255 steps (0 to 255). The fine gain and coarse gain ranges allow a choice accuracy from 0.15 to 480. As an example, the following tables contain some extremity gain values obtained with the indicated shaping times and gain settings (positive input signals).

**Table 3.1: Gain Values (Signals risetime: 10  $\mu$ s)**

<b>Gain values</b> (Input Signals risetime: 10 $\mu$ s)								
Shape Times	0.2 $\mu$ s		1 $\mu$ s		3 $\mu$ s		6 $\mu$ s	
	Fine Gain		Fine Gain		Fine Gain		Fine Gain	
Coarse Gain	0	255	0	255	0	255	0	255
0	0.15		0.6		1.13		1.25	
7		38.02		153.64		286.45		322.91

**Table 3.2: Gain Values (Signals risetime: 0.05  $\mu$ s)**

<b>Gain values</b> (input Signals risetime: 0.05 $\mu$ s)								
Shape Times	0.2 $\mu$ s		1 $\mu$ s		3 $\mu$ s		6 $\mu$ s	
	Fine Gain		Fine Gain		Fine Gain		Fine Gain	
Coarse Gain	0	255	0	255	0	255	0	255
0	1.25		1.88		1.86		1.6	
7		260.41		476.56		481.77		416.6

### 3.2.6 POLE ZERO ADJUSTMENT

This setting can be done either via Manual Controller or via H. S. CAENET. Adjustable on 256 steps to match preamp tails in a range from 50  $\mu$ s to 500  $\mu$ s.

### 3.2.7 OFFSET SETTING

This setting can be done either via Manual Controller or via H. S. CAENET. Allows to add an offset value to shift the baseline of the output. Allowed values are from -75 mV to +210 mV with Positive Output Polarity; from +75 mV to -210 mV with Negative Output Polarity.

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### 3.3 H. S. CAENET

The H. S. CAENET Network is a send and receive half duplex system; It enables the asynchronous serial transmission (1 MBaud rate) of data packets along a simple 50 Ohm coaxial cable. Several devices (H. S. CAENET nodes) are able to share the same media to transmit and receive data. Each node is able to receive the serial data packet and store it automatically in a FIFO (RX FIFO) and transmit the data contained in another FIFO (TX FIFO). Both FIFOs are 512 byte deep.

Usually transfers between H. S. CAENET nodes take place according to the typical Master/Slaves communication:

- There is a single Master : H. S. CAENET controller
- The Slaves are daisy chained on the network, and are identified by an address code (from 1 to 99);
- the H. S. CAENET Master initiates the transmission, all the Slaves receive the data, and only the Slave addressed then accesses the serial line to transmit the data requested by the Master.
- The maximum data packet length is 512 bytes.

The address of the H. S. CAENET node of the N568B/LC (Station #) is selectable via front panel thumb-wheels, and its value ranges from 1 to 99. In this way up to 99 modules may be controlled from a single point via one of the following CAEN H. S. CAENET Controllers:

A1303 H. S. CAENET PC Controller (PCI bus);  
A303A H. S. CAENET PC Controller;  
A303 H. S. CAENET PC Controller;  
A250 H. S. CAENET Manual Controller;  
C117B H. S. CAENET CAMAC Controller;  
V288 H. S. CAENET VME Controller.

To avoid reflections it is necessary to terminate the H. S. CAENET line on a 50  $\Omega$  impedance. This is accomplished by inserting a 50  $\Omega$  impedance terminator in one of the two LEMO 00 type connectors (IN/OUT) of the last module of the chain.

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## 4. H. S. CAENET OPERATION

The Model N568B/LC is provided with an H. S. CAENET node through which it can be controlled by the following H. S. CAENET Controllers:

<b>Mod. A250</b>	- H. S. CAENET Manual Controller;
<b>Mod. V288</b>	- H. S. CAENET VME Controller;
<b>Mod. C117B</b>	- H. S. CAENET CAMAC Controller;
<b>Mod. A303</b>	- H. S. CAENET PC Controller.

**NOTE: the address number of the N568B/LC (Station #) must be the only one in the line in which you wish to insert the module. Due to high transmission speed of the data in line it is necessary to terminate this line on a 50  $\Omega$  impedance at the end to avoid reflections.**

Via H. S. CAENET it is possible to select the desired output channel, that will thus provide the same input signal.

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### 4.1 USING THE H. S. CAENET MANUAL CONTROLLER

The Mod. N568B/LC can be controlled remotely via VME through the Mod. A250 H. S. CAENET Manual Controller. The Mod. A250 has been designed to control a H. S. CAENET node via 50  $\Omega$  coaxial cable.

The sequence of display pages in the Manual Controller is not exactly as in the suggested first-settings procedure (see § 3.2), but after a first setting is performed, the first page appearing in the Display is the Gain setting page, which is the most frequently accessed page.

In order to use the Manual Controller, the User must connect it to the N568B/LC, using a 50 Ohm coaxial cable into the "H. S. CAENET IN/OUT" connectors of the N568B/LC; the supply of the Manual Controller is provided from the N568B/LC front panel via suitable cable (RCA connectors) supplied by CAEN with the Manual Controller. Once supplied, the Manual Controller's display will appear as follows:

```
CAEN A250  1.0
Select Cr.  **
```

where 1.0 is the Firmware release version of the Controller itself.

Type the address number of the module, previously set via thumb-wheel switch on the front panel, and confirm the choice with the key "#". The display will show:

```
AA  Software
N568 Version x.x
```

where AA is the selected address number. The version number is the N568B/LC Firmware version. By pressing the "PAGE" key, the display will appear as follows:



AA	Ch**	Fg	NNN
N568		Cg	M

where AA is still the selected address number. The address number starts blinking, indicating the currently modifiable field. By pressing the key "#", the blinking can be moved on the Ch (Channel Number) field: by pressing "ROLL" it is possible to increment the value of the Channel Number by 1 (Channel values: 0 to 15). This number indicates the Channel on which all following settings are performed. By pressing the key "#" the blinking toggles to the Fg (Fine Gain) field in the display (NNN in the figure above): by pressing "0" or "1" it is possible respectively to decrement/increment the value of the Fine Gain by 1, while by pressing "4" or "7" it is possible respectively to decrement/increment the value of the Fine Gain by 10 (allowed Fine Gain values: 0 to 255). By pressing the key "#" the blinking toggles to the Cg (Coarse Gain) field in the display (M in the figure above): by pressing "ROLL" it is possible to increment the value of the Coarse Gain by 1 (allowed Coarse Gain values: 0 to 7).

By pressing the "PAGE" key, the display will appear as follows:

AA	Ch**	PZ	NNN
N568		Sh	L

where AA is the selected address number. By pressing the key "#" the blinking toggles from the position of the blinking field in the previous page to the following at its right. By pressing the key "#", the blinking can be moved on the Ch (Channel Number) field: by pressing "ROLL" it is possible to increment the value of the Channel Number by 1 (Channel values: 0 to 15). This number indicates the Channel on which all following settings are performed. By pressing the key "#" the blinking toggles to the PZ (Pole Zero adjustment) field in the display (NNN in the figure above): by pressing "0" or "1" it is possible respectively to decrement/increment the value of the Pole Zero adj. by 1, while by pressing "4" or "7" it is possible respectively to decrement/increment the value of the Pole Zero adj. by 10 (allowed Pole Zero adj. values: 0 to 255). By pressing the key "#" the blinking toggles to the Sh (Shaping Time) field in the display (L in the figure above): by pressing "ROLL" it is possible to increment the value of the Shaping Time by 1 (allowed Shaping Time values: 0 to 3).

By pressing the "PAGE" key, the display will appear as follows:

AA	Ch**	Out	Pos
N568		Out	NInv

where AA is the selected address number. By pressing the key "#" the blinking toggles from the position of the blinking field in the previous page to the following at its right. By pressing the key "#", the blinking can be moved on the Ch (Channel Number) field: by pressing "ROLL" it is possible to increment the value of the Channel Number by 1 (Channel values: 0 to 15). This number indicates the Channel on which all following settings are performed. By pressing the key "#" the blinking toggles to the higher row OUT (Output Polarity) field in the display (Pos in the figure above): by pressing "ROLL" it is possible to switch from Positive (Pos) to Negative (Neg) polarity. By pressing the key "#" the blinking toggles to the lower row OUT (Output configuration) field in the display (Ninv in the figure above): by pressing "ROLL" it is possible to switch from Non-inverting (Ninv) to Inverting (Inv) configuration.

By pressing the "PAGE" key, the display will appear as follows:

AA	Offset
N568	NNN

where AA is the selected address number. By pressing the key "#" the blinking toggles from the position of the blinking field in the previous page to the following at its right. By pressing the key "#" the blinking toggles to the Offset (Offset adjustment) field in the display (NNN in the figure above): by pressing "0" or "1" it is possible respectively to decrement/increment the value of the Offset adj. by 1, while by pressing "4" or "7" it is possible respectively to decrement/increment the value of the Offset adj. by 10 (allowed Offset adj. values: 0 to 255). The Offset is the same for all Channels.

By pressing the "PAGE" key, the display will appear as follows:

AA	Mux Out
N568	XXXXXXXX

where AA is the selected address number. By pressing the key "#" the blinking toggles from the position of the blinking field in the previous page to the following at its right. By pressing the key "ENTER" it is possible to disable or enable the Multiplexed Outputs. The status of the Multiplexed Outputs will appear in the XXXXXXXX field ("Disabled" or "Enabled").

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## 4.2 USING THE H. S. CAENET VME CONTROLLER

The Mod. N568B/LC can be controlled remotely via VME through the Mod. V 288 H. S. CAENET VME Controller.

The Model V288 has been designed to control an H. S. CAENET node through the VME bus. It is composed of a collection of registers, for the operation control, and two memory buffers for the transmitted and received data packets, arranged in a FIFO logic 16 bit wide 256 words deep. In the memory buffer for the received data are also stored the error messages generated by the V288 itself when the H. S. CAENET operation has failed.

Standard VME cycles allow the User to perform the required control and setting operations on each Mod. N568B/LC in the network, according to the typical MASTER/SLAVE communication protocol, where the VME controller assumes the MASTER function. The module's operations can be software controlled in polling mode or can be handled via interrupt facility. It houses a VME ROAK INTERRUPTER that generates a VME interrupt (if enabled) as soon as the data packet (or the error message) is stored in the receive buffer.

The Registers of the Mod. V288 are described in the Table 4.1.

**Table 4.1: Mod. V288 Registers**

NAME	TYPE	ADDRESS	FUNCTION
Transmit Data Buffer	Write only	Base Address + %00	Transmit data storage
Receive Data Buffer	Read only	Base Address + %00	Receive data storage
Status Register	Read only	Base Address + %02	After an H. S. CAENET operation has been performed, This register indicates whether the operation is valid or not FFFE= valid operation FFFF= no valid operation
Transmission Register	Write only	Base Address + %04	By writing into this register the Transmit Data buffer content is transmitted on the cable
Reset Register	Write only	Base Address + %06	Module's Reset
Interrupt Vector Register	Write only	Base Address + %08	Interrupt vector programming register

#### 4.2.1 Master to Slave data composition (V288 case)

The Master to Slave data have to be written in the Transmit Data Buffer, by performing subsequent write accesses as follows:

**Table 4.2: Master to Slave data composition (V288 case)**

Order	Operation	Address	Datum (HEX)	Meaning
1	Write	Base Ad. + 0	%0001	H. S. CAENET Controller identified code
2	Write	Base Ad. + 0	%00XX	Module Number
3	Write	Base Ad. + 0	Code	First word of the Operation Code to be performed
4	Write	Base Ad. + 0	Code/Set	Possible subsequent word of the Set value

As soon as the data packet has been stored in the Transmit Data Buffer, it can be transmitted on the cable by performing a Write operation on the Transmission Register. The Operation Codes are shown in Tab. 4.7.

After a transmission, in the V288 Receive Data Buffer the User reads the Slave response or a V288 error message (e. g., if the V288 does not receive any Slave response within a period of 500 msec it stores the code %FFFF in the Receive Data Buffer, see Table 4.10).

#### 4.2.2 Slave to Master data composition (V288 case)

The answer data coming from the Mod. N568B/LC or a Mod. V288 error message are automatically stored into the V288 Receive Data buffer and therefore are available to the User. As soon as the data packet is stored in this buffer, a VME interrupt (if enabled) is generated.

The following Table shows the structure of the N568B/LC data packet:

**Table 4.3: Slave to Master data composition (V288 case)**

Order	Operation	Address	Datum	Meaning
1	Read	Base Ad. + 0	Error Code	Error code
2 to 50(*)	Read	Base Ad. + 0	value	Possible Parameter values

(\*) The first data of the packet is read and checked by the V288 Control Logic (see *V288 User's Manual*).

The Error Codes are described in Tab. 4.10.

### 4.3 USING THE H. S. CAENET CAMAC CONTROLLER

The Mod. N568B/LC can be controlled remotely via CAMAC through the Mod. C 117B H. S. CAENET CAMAC Controller.

The Model C 117B has been designed to control an H. S. CAENET node through the CAMAC bus. It houses two memory buffers for the transmitted and received data packet, arranged in a FIFO logic 16 bit wide 256 words deep.

In the memory buffer for the received data are also stored the error messages generated by the C117B itself when the H. S. CAENET operation has failed (see Table 4.10).

The standard CAMAC functions listed in Table 4.4 allow the User to perform the required control and setting operations on each Mod. N568B/LC in the network according to the typical MASTER/SLAVE communication protocol, where the CAMAC controller assumes the MASTER function.

As soon as the data packet (or the error message) is stored in the receive buffer, a LAM signal is generated (if enabled).

X response is generated for all valid function. Q response is generated for each valid function unless is otherwise specified (see Table below).

**Table 4.4: Mod. C 117 B CAMAC Functions**

<b>F(0) N</b>	Reads the data stored in the mod. C 117 B Receive Data buffer. Q response while the buffer contains data.
<b>F(8) N</b>	Tests the LAM line. Q response if LAM is true.
<b>F(9) N</b>	Resets the module (clears buffer and LAM; disables the LAM line).
<b>F(16) N</b>	Stores the data into the Mod. C 117 B Transmit Data buffer. Q response until the buffer is full (256 16-bit words).
<b>F(17) N</b>	Transfers data to the serial line.
<b>F(24) N</b>	Disables the LAM line.
<b>F(26) N</b>	Enables the LAM line.
<b>C, Z</b>	Same as F(9) N.

### 4.3.1 Master to Slave data composition (C117B case)

The MASTER-to-SLAVE data have to be written into the Transmit Data buffer by performing subsequent F(16) N functions as follows:

**Table 4.5: Master to Slave data composition (C117B case)**

Order	CAMAC Function	W16 to W1 (HEX)	Meaning
1	F(16) N	%0001	H. S. CAENET Controller identified code
2	F(16) N	%00XX	Module Number
3	F(16) N	Code	First word of the Operation Code to be performed
4	F(16) N	Code/Set	Possible subsequent word of the Set value

After the required F(16) N functions have been performed, it is necessary to carry out an F(17) N function in order to transfer the stored data to the addressed module. The Operation Codes are shown in Tab. 4.7.

A LAM signal is generated (if enabled) as soon as the response data packet is stored into the C117B Receive Data buffer. The LAM is cleared whenever the last datum has been read. If the LAM has not been enabled after the F(17) N function the F(0) N function must be repeated until a Q=1 response is obtained. The readout is over when Q=0 (Q STOP readout operation).

In the C117 B Receive Data Buffer the User reads the N568B/LC response or a C117 B error message (e. g., if the C117 B does not receive any Slave response within a period of 500 msec it stores the code %FFFF in the Buffer, see Tab. 4.10).

### 4.3.2 Slave to Master data composition (C117B case)

The answer data coming from the Mod. N568B/LC or a Mod. C 117 B error message are automatically stored into the C117 B Data buffer and therefore are available to the User. As soon as the data packet is stored in this buffer, a LAM (if enabled) is generated.

The following Table shows the structure of the N568B/LC data packet:

**Table 4.6: Slave to Master data composition (C117B case)**

Order	CAMAC Function	Datum	Meaning
1	F(0) N	Error Code	Error code
2 to 50(*)	F(0) N	value	Possible Parameter value

(\*) The first data of the packet is read and checked by the C117B Control Logic (see *C117B Technical Information Manual*).

The Error Codes are described in Tab 4.10.

### 4.3.3 MASTER TO SLAVE OPERATING CODES (CAMAC and VME)

The MASTER-to-SLAVE Operating Codes of the module N568B/LC have the following structure:

- Word 1 is a %1, Controller identified code;
- Word 2 is %XX, where XX is the Hexadecimal value of the front panel Decimal Station Number;
- Words 3 and 4 can be chosen according to Table 4.7.

**Table 4.7: Operating Codes of the N568B/LC (C117B and V288 case)**

word 3 (Hex)*	word 4**	Meaning
%0	==	Module identifier
%1	==	Read all Parameters for all Channels + Offset Value
%2	==	Read Offset Value
%n3	==	Read all Parameters for Channel n
%4	==	Read MUX Enable Status & Last Accessed Channel
%n10	%m	Set Channel n Fine Gain
%n11	%p	Set Channel n Coarse Gain
%n12	%m	Set Channel n Pole Zero Adjustment
%n13	%q	Set Channel n Shape
%n14	%b	Set Channel n Output Polarity
%n15	%b	Set Channel n Output Configuration
%16	%m	Set Offset Value
%20	==	Disable Multiplexed Outputs
%21	==	Enable Multiplexed Outputs

\*) n is the Channel Number (0 to F for a selected channel, 10 for a set/read in common to all Channels);

\*\*) allowed values (HEX):

- m=0 to FF;
- p=0 to 7;
- q=0 to 3;
- b=0 to 1;

## 4.4 SET VALUES

**Operating Code %10;** the allowed Fine Gain values are %0 to %FF.

**Operating Code %11;** the allowed Coarse Gain values for each Channel are 0 to 7: each step corresponds approximately to a doubling of the Coarse Gain value. Due to the dependence of the Gain value from the Shaping Times and Input Signal Risetimes, it is meaningless to quote an absolute Gain value setting (see §3.2.5). As an example, if the measured amplifier Gain (@ Coarse Set value 0, Fine Set value 0, Shaping time 0.2  $\mu$ s and Input Signals Rise Time 0.2  $\mu$ s) is 1, it will be 16 at set value 4 with the same configuration on the other settings. Relative set Values are given as follows:

**Table 4.8: Coarse Gain Values**

Code %11 Set	Relative Coarse Gain Value (approx.)
%0	1
%1	2
%2	4
%3	8
%4	16
%5	32
%6	64
%7	128

**Operating Code %12;** the allowed Pole Zero values for each Channel are %0 to %FF, allowing to match the preamplifier tails in a range 50-500  $\mu$ s.

**Operating Code %13;** the allowed Shape values for each Channel are %0 to %3, corresponding to the Shaping Time Values as follows:

**Table 4.9: Shape Values**

Code %13 Set	Shape Value
%0	0.2 $\mu$ s
%1	1 $\mu$ s
%2	3 $\mu$ s
%3	6 $\mu$ s

**Operating Code %14;** the allowed Output Polarity values for each Channel are 0 or 1, corresponding respectively to Positive (0) or Negative (1) Output Polarity.

**Operating Code %15;** the allowed Output Configuration values for each Channel are 0 or 1, corresponding respectively to Direct (0) or Inverted (1) Outputs.

**Operating Code %16;** the allowed Offset value in common to all Channels is %0 to %FF.

## 4.5 SLAVE TO MASTER DATA PACKET DESCRIPTION (CAMAC and VME)

The answer data coming from the Mod. N568B/LC or from the H. S. CAENET CAMAC or VME Controllers are different according to the different Operating Codes performed.

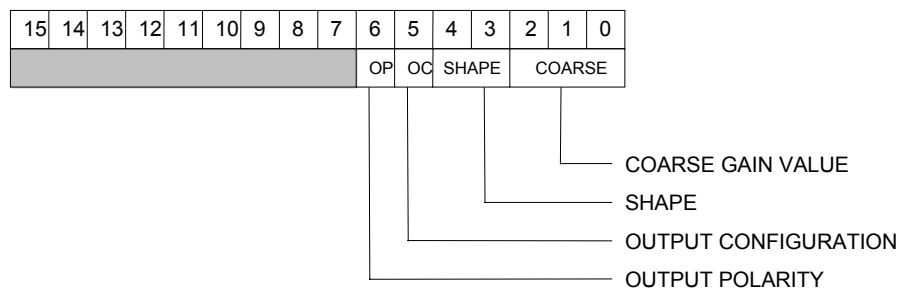
**Operating Code %0**; the N568B/LC response to a Module Identifier Operation is a group of 16 bit words structured as follows:

- Error Code;
- Module Identifier's first word;
- ...
- ...
- Module Identifier's sixteenth word.

**Operating Code %1**; the N568B/LC response to a Read all Parameters for all Channels + Offset Value is a group of 50 words (16 bit) structured as follows:

- Error Code;
- Fine Gain Value CH0;
- Pole Zero CH0;
- Status Register CH0;
- Fine Gain Value CH1;
- Pole Zero CH1;
- Status Register CH1;
- .....
- .....
- Fine Gain Value CH15;
- Pole Zero CH15;
- Status Register CH15;
- Offset Value.

The Fine Gain Value and the Pole Zero can be %0 to %FF. The Status Register Word encodes on 7 bits the Coarse Gain Value, the Shape, the Output Polarity and the Output Configuration as shown in Fig. 4.1.



**Fig. 4.1: Mod. N568B/LC Status Register**



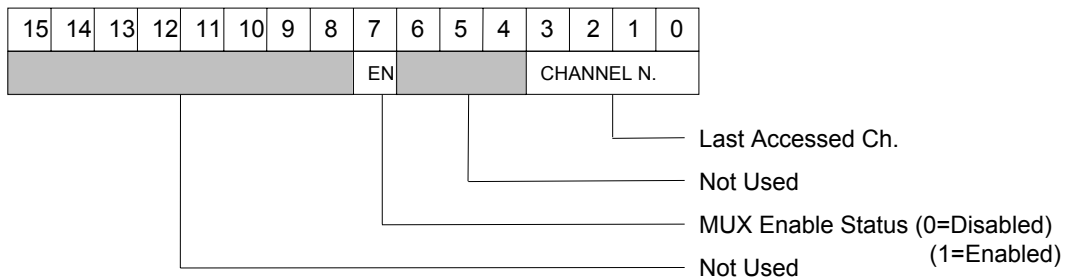
**Operating Code %2;** the N568B/LC response to a Read Offset Value is a group of 16 bit words structured as follows:

- Error Code;
- Offset Value.

**Operating Code %3;** the N568B/LC response to a Read all Parameters for selected Channel is a group of 4 words (16 bit) structured as follows:

- Error Code;
- Fine Gain Value selected Channel;
- Pole Zero selected Channel;
- Status Register selected Channel.

**Operating Code %4;** the N568B/LC response to a Read MUX Enable Status & Last Accessed Channel is a word (16 bit) structured as follows:



**Operating Codes %10 through %16;** the N568B/LC response to any of the 7 Set operations is the Error Code:

- Error Code.

### 4.5.1 Error Codes description

The Error Codes provided by the CAENET CAMAC and VME Controllers are described in the following Table:

**Table 4.10: Error Codes (C117B and V288 case)**

Datum (Hex)	Meaning
%0	Successful operation.
%FF00	Module Busy; the Controller has tried to effect an operation while the module is setting the display brightness.
%FF01	Code not recognized or message incorrect.
%FF02	Value out of range.
%FFFD	No data to be transmitted; a start transmission with the Transmit Data Buffer empty has been attempted (H. S. CAENET Controller error message).
%FFFE	The H.S. CAENET Controller Identifier is incorrect (H. S. CAENET Controller error message).
%FFFF	The addressed module does not exist. This message is generated after a period of 500 msec (H. S. CAENET Controller error message).

## 4.5.2 Module Identifier Packet (response to code %0)

The response contains in the low byte the ASCII code of the string of characters identified by the name of the Module plus the version of the software running on the Main Controller.

**Table 4.11: Module Identifier Data Packet Structure**

Word	Contents	
	bits 15..8	bits 7..0
2	0	"N"
3	0	"5"
4	0	"6"
5	0	"8"
6	0	" "
7	0	"V"
8	0	"e"
9	0	"r"
10	0	"s"
11	0	"i"
12	0	"o"
13	0	"n"
14	0	" "
15	0	"x"
16	0	"."
17	0	"x"

## 4.6 USING THE H. S. CAENET PC CONTROLLERS

The Mod. N568B/LC can be controlled remotely via a standard PC through the Mod. A303, A303A and A1303 H. S. CAENET PC Controllers.

The Mod. A303 is an 8-bit interface board that can be directly inserted into a std. I/O PC 8-bit slot and it is mapped in the MS-DOS I/O or memory address space. Therefore it is controllable by all the languages (high level or assembly), independently from the processor type.

Dip switches located on the printed circuit board allow the User to set the unit according to the computer to be used (for more information see the Mod. A303 Technical Information Manual).

The board interfaces directly the 8-bit bus with the two FIFO buffers (TX and RX FIFO), and with 6 internal registers that are used for various functions such as the FIFO clearing, the start transmission and the readout of the Node status.

The Host processor can control the Node operation in polling mode or using the interrupt facility.

Due to the 8-bit board, in the case of the A303 PC Controller, Operating Codes and Slave responses are coded as 8-bit Bytes.

The Mod. A303A HIGH SPEED (H.S.) CAENET CONTROLLER is an ISA interface card. It allows the control of an H.S. CAENET network through a standard PC.

The card can be mapped either in the I/O or Memory space of the PC (dip switch selectable).

Moreover the Mod. A 303A Controller can operate either in Polling or Interrupt mode (dip switch selectable).

The communication line uses a simple 50  $\Omega$  coaxial cable as its physical transmission medium.

The Mod. A1303 PCI CAENET CONTROLLER is a 32-bit PCI interface card. It allows the control of a HS CAENET network through a standard PC.

The communication line uses a 50  $\Omega$  coaxial cable as its physical transmission medium.

**Table 4.12: HS CAENET PC CONTROLLERS registers**

Register/Buffer	Address	Operation	DESCRIPTION
TX FIFO	Base Ad. + 0	write	TX FIFO (512 byte max. depth) Transmit Data Buffer.
START TX	Base Ad. + 1	write	Starts the transmission of the TX FIFO data
RESET	Base Ad. + 3	write	Clears TX and RX buffers and resets all the Interrupt signals.
RX FIFO	Base Ad. + 0	read	RX FIFO (512 byte max. depth) Receive Data Buffer.
STATUS REGISTER	Base Ad. + 1	read	8-bit Status register.
RESET INTERRUPT	Base Ad. + 2	read	Reads the Status register and clears a present interrupt.
CLEAR RX FIFO	Base Ad. + 3	read	Clears the RX FIFO

## 4.7 BOARD CONTROL VIA OPC SERVER

CAEN, in close collaboration with CERN (IT/CO group), has developed an OPC server which allows powerful, flexible, and yet simple control of its modules, indifferently through H.S. CAENET communication path, by any OPC compliant client application.

Version 2.4 and later of CAEN HV OPC Server are fully compliant with the OPC Data Access 2.0 specifications. The A303A and the A1303 HS CAENET controllers allow to control the N568B and N568LC via OPC server, through a complete set of programmable/monitorable items, which are described in the following subsections. Anyway, for an extensive description, the CAEN OPC Server User's Manual is available too.

### 4.7.1 N568B / N568LC board control

This chapter describes the Items which are available for the control of the N568B / N568LC module.

A read access to the **ModelName** item returns a string with the board model.

A read access to the **SwRelease** item returns a string with the board software release.

A read access to the **CnetCrNum** item returns the board Caenet crate number.

A read access to the **Slots** item returns the number of the board's slots (1).

A read access to the **Model** item returns a string with the board's name.

A read access to the **Description** item returns a string with the board synthetic description.

A read access to the **FmwRelease** item returns a string with the board firmware release.

A read access to the **SerNum** item returns a string with the board serial number.

A read access to the **NrOfCh** item returns the number of board's channels.

The **MuxOut** item allows to enable the Multiplexed Output; see the board's User's manual for further details.

A read access to the **MuxOut#CoClose** item returns back the label "Enable" associated to Multiplexed Output Enabled.

A read access to the **MuxOut#CoOpen** item returns back the label "Disable" associated to Multiplexed Output Disabled.

The **LastCh** item returns the Latest Channel accessed; see the board's User's manual for further details.

A read access to the **LastCh#EU** item returns a string with the Latest Channel Engineering Units.

A read access to the **LastCh#HighEU** item returns the highest possible Latest Channel value.

A read access to the **LastCh#LowEU** item returns the lowest possible Latest Channel value.

The **Offset** item allows to set the Offset; see the board's User's manual for further details.

A read access to the **Offset#EU** item returns a string with the Offset Engineering Units.

A read access to the **Offset#HighEU** item returns the highest possible Offset value.

A read access to the **Offset#LowEU** item returns the lowest possible Offset value.

**Table 4.13– N568B / N568LC Board Items**

ItemID	Data Type	Access Rights	Description
N568B.ModelName	String	R	Board model
N568B.SwRelease	String	R	Board software release
N568B.CnetCrNum	2 byte integer	R	Caenet crate number
N568B.Slots	2 byte integer	R	Number of slots
N568B.BoardXX.Model	String	R	Board name
N568B.BoardXX.Description	String	R	Synthetic description
N568B.BoardXX.FmwRelease	String	R	Board firmware release
N568B.BoardXX.SerNum	String	R	Board serial number
N568B.BoardXX.NrOfCh	2 byte integer	R	Number of board channels

N568B.BoardXX.MuxOut	Boolean	R/W	Enable Multiplexed Output
N568B.BoardXX.MuxOut#CoClose	String	R	Multiplexed Out close label
N568B.BoardXX.MuxOut#CoOpen	String	R	Multiplexed Out open label
N568B.BoardXX.Last	4 byte integer	R/W	Latest channel value
N568B.BoardXX.Last#EU	String	R	Latest ch. EU
N568B.BoardXX.Last#HighEU	8 byte integer	R	Latest ch. upper limit
N568B.BoardXX.Last#LowEU	8 byte integer	R	Latest ch. lower limit
N568B.BoardXX.Offset	4 byte integer	R/W	Offset value
N568B.BoardXX.Offset#EU	String	R	Offset EU
N568B.BoardXX.Offset#HighEU	8 byte integer	R	Offset upper limit
N568B.BoardXX.Offset#LowEU	8 byte integer	R	Offset lower limit

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#### 4.7.2 N568B / N568LC channel control

This chapter describes the Items which are available for the control of a N568B / N568LC channel.

The **Name** item allows to assign to the channel a symbolic name.

The **FineGain** item allows to set Fine Gain; see the board User's manual for details.

A read access to the **FineGain#EU** item returns a string with the Fine Gain Engineering Units.

A read access to the **FineGain#HighEU** item returns the highest possible Fine Gain value.

A read access to the **FineGain#LowEU** item returns the lowest possible Fine Gain value.

The **CoarGain** item allows to set Coarse Gain; see the board User's manual for further details.

A read access to the **CoarGain#EU** item returns a string with the Coarse Gain Engineering Units.

A read access to the **CoarGain#HighEU** item returns the highest possible Coarse Gain value.

A read access to the **CoarGain#LowEU** item returns the lowest possible Coarse Gain value.

The **PoleZAdj** item allows the Pole Zero Adjustment; see the board User's manual for further details.

A read access to the **PoleZAdj#EU** item returns a string with the Pole Zero Adjustment Engineering Units.

A read access to the **PoleZAdj#HighEU** item returns the highest possible Pole Zero Adjustment value.

A read access to the **PoleZAdj#LowEU** item returns the lowest possible Pole Zero Adjustment value.

The **Shape** item allows the Shape setting; see the board User's manual for further details.

A read access to the **Shape#EU** item returns a string with the Shape Engineering Units.

A read access to the **Shape#HighEU** item returns the highest possible Shape value.

A read access to the **Shape#LowEU** item returns the lowest possible Shape value.

The **OutPol** item allows to set the Output Polarity; see the board User's manual for further details.

A read access to the **OutPol#CoClose** item returns back the label "Negative" associated to Negative output polarity.

A read access to the **OutPol#CoOpen** item returns back the label "Positive" associated to Positive output polarity.

The **OutConf** item allows to set the Output Configuration; see the board User's manual for further details.

A read access to the **OutConf#CoClose** item returns back the label "Inverted" associated to Inverted output.

A read access to the **OutConf#CoOpen** item returns back the label "Direct" associated to Direct output.

Table 4.14– N568B / N58LC Channel items

ItemID	Data Type	Access Rights	Description
N568B.BoardXX.ChanYYY.Name	String	R/W	Channel name
N568B.BoardXX.ChanYYY.FineGain	4 byte integer	R/W	Set Fine Gain
N568B.BoardXX.ChanYYY.FineGain#EU	String	R	Fine Gain EU
N568B.BoardXX.ChanYYY.FineGain#HighEU	8 byte integer	R	Fine Gain upper limit
N568B.BoardXX.ChanYYY.FineGain#LowEU	8 byte integer	R	Fine Gain lower limit
N568B.BoardXX.ChanYYY.CoarGain	4 byte integer	R/W	Set Coarse Gain
N568B.BoardXX.ChanYYY.CoarGain#EU	String	R	Coarse Gain EU
N568B.BoardXX.ChanYYY.CoarGain#HighEU	8 byte integer	R	Coarse Gain upper limit
N568B.BoardXX.ChanYYY.CoarGain#LowEU	8 byte integer	R	Coarse Gain lower limit
N568B.BoardXX.ChanYYY.PoleZAdj	4 byte integer	R/W	Allows Pole Zero Adjustment
N568B.BoardXX.ChanYYY.PoleZAdj#EU	String	R	Pole Zero Adjustment EU
N568B.BoardXX.ChanYYY.PoleZAdj#HighEU	8 byte integer	R	Pole Zero Adj. upper limit
N568B.BoardXX.ChanYYY.PoleZAdj#LowEU	8 byte integer	R	Pole Zero Adj. lower limit
N568B.BoardXX.ChanYYY.Shape	4 byte integer	R/W	Set Shape
N568B.BoardXX.ChanYYY.Shape#EU	String	R	Shape EU
N568B.BoardXX.ChanYYY.Shape#HighEU	8 byte integer	R	Shape upper limit
N568B.BoardXX.ChanYYY.Shape#LowEU	8 byte integer	R	Shape lower limit
N568B.BoardXX.ChanYYY.OutPol	Boolean	R/W	Set Output Polarity
N568B.BoardXX.ChanYYY.OutPol#CoClose	String	R	Out polarity close label
N568B.BoardXX.ChanYYY.OutPol#CoOpen	String	R	Out polarity open label
N568B.BoardXX.ChanYYY.OutConf	Boolean	R/W	Set Output Configuration
N568B.BoardXX.ChanYYY.OutConf#CoClose	String	R	Out configuration close label
N568B.BoardXX.ChanYYY.OutConf#CoOpen	String	R	Out configuration open label

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## 4.8 DATA COMPOSITION (PC CONTROLLER CASE)

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### 4.8.1 Master to Slave Data Composition (PC Controller Case)

The MASTER-to-SLAVE data have to be written into the Transmit Data buffer by performing subsequent write operations as described in the table below:

**Table 4.15: Master to Slave data composition**

Order	Operation	Address	Datum (HEX)	Meaning
1	write	Base Ad. + 0	low byte = %01	H.S. CAENET Controller identified code
	write	Base Ad. + 0	high byte = %00	
2	write	Base Ad. + 0	low byte = %XX	Module Number
	write	Base Ad. + 0	high byte = %00	
3	write	Base Ad. + 0	low byte Code	First 2 Bytes of the Operation Code to be performed
	write	Base Ad. + 0	high byte Code	
4	write	Base Ad. + 0	low byte Code/Set	Possible 2 Bytes of the Set value
	write	Base Ad. + 0	high byte Code/Set	

#### 4.8.2 Slave to Master Data Composition (PC Controller Case)

The answer data coming from the N568B/LC are automatically stored into the HS CAENET controller Receive Data buffer and therefore are available to the User.

The following Table shows the structure of the N568B/LC data packet:

**Table 4.16: Slave to Master data composition**

Order	Operation	Address	Datum	Meaning
1	read	Base Ad. + 0	low byte = %01	H. S. CAENET Controller identified code
	read	Base Ad. + 0	high byte = %00	
2	read	Base Ad. + 0	low byte Error code	Error code
	read	Base Ad. + 0	high byte Error code	
3 to 100(*)	read	Base Ad. + 0	low byte value	Possible Parameter value
	read	Base Ad. + 0	high byte value	

## 4.9 MASTER TO SLAVE OPERATING CODES (PC CONTROLLER CASE)

The MASTER-to-SLAVE Operating Codes of the module N568B/LC have the following structure:

- Byte 1: %01 (Low Byte Controller identified code);
- Byte 2: %00 (High Byte Controller identified code);
- Byte 3: %XX (Low Byte Module Number);
- Byte 4: %00;
- Byte 5 ÷ 8: see Table 4.17



Table 4.17: Operating Codes of the N568B/LC

Byte 5 (Hex)	Byte 6*	Byte 7**	Byte 8	Meaning
%0	0	==	==	Module identifier
%1	0	==	==	Read all Parameters for all Channels + Offset Value
%2	0	==	==	Read Offset Value
%3	%n	==	==	Read all Parameters for Channel n
%4	0	==	==	Read MUX Enable Status & Last Accessed Channel
%10	%n	%m	0	Set Channel n Fine Gain
%11	%n	%p	0	Set Channel n Coarse Gain
%12	%n	%m	0	Set Channel n Pole Zero Adjustment
%13	%n	%q	0	Set Channel n Shape
%14	%n	%b	0	Set Channel n Output Polarity
%15	%n	%b	0	Set Channel n Output Configuration
%16	0	%m	0	Set Offset Value
%20	0	==	==	Disable Multiplexed Outputs
%21	0	==	==	Enable Multiplexed Outputs

\*) n is the Channel Number (%0 to %F for a selected channel, %10 for a set/read in common to all Channels);

\*\*) allowed values (HEX):

m=0 to FF;

p=0 to 7;

q=0 to 3;

b=0 to 1;

---

## 4.10 SET VALUES

**Operating Code %10;** the allowed Fine Gain values are %0 to %FF, corresponding approximately to a multiplying factor from 0.2 (%0) to 2 (%FF) to be applied to the Coarse Gain value.

**Operating Code %11;** the allowed Coarse Gain values for each Channel are 0 to 7: each step corresponds approximately to a doubling of the Coarse Gain value. Due to the dependence of the Gain value from the Shaping Times and Input Signal Risetimes, it is meaningless to quote an absolute Gain value setting (see §3.2.5). As an example, if the measured amplifier Gain (@ Coarse Set value 0, Fine Set value 0, Shaping time 0.2  $\mu$ s and Input Signals Rise Time 0.2  $\mu$ s) is 1, it will be 16 at set value 4 with the same configuration on the other settings. Relative set Values are given as follows:

**Table 4.18: Coarse Gain Values**

Code %11 Set	Relative Coarse Gain Value (approx.)
%0	1
%1	2
%2	4
%3	8
%4	16
%5	32
%6	64
%7	128

**Operating Code %12;** the allowed Pole Zero values for each Channel are %0 to %FF, allowing to match the preamplifier tails in a range 50-500  $\mu$ s.

**Operating Code %13;** the allowed Shape values for each Channel are %0 to %3, corresponding to the Shaping Time Values as follows:

**Table 4.19: Shape Values**

Code %13 Set	Shape Value
%0	0.2 $\mu$ s
%1	1 $\mu$ s
%2	3 $\mu$ s
%3	6 $\mu$ s

**Operating Code %14;** the allowed Output Polarity values for each Channel are 0 or 1, corresponding respectively to Positive (0) or Negative (1) Output Polarity.

**Operating Code %15;** the allowed Output Configuration values for each Channel are 0 or 1, corresponding respectively to Direct (0) or Inverted (1) Outputs.

**Operating Code %16;** the allowed Offset value in common to all Channels is %0 to %FF.

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## 4.11 SLAVE TO MASTER DATA PACKET DESCRIPTION (PC CONTROLLER CASE)

The answer data coming from the Mod. N568B/LC or from the H. S. CAENET CAMAC or VME Controllers are different according to the different Operating Codes performed.

**Operating Code %0;** the N568B/LC response to a Module Identifier Operation is a group of 8 bit Bytes structured as follows:

- %01 (Low Byte of Master Identifier Code);
- %00 (High Byte of Master Identifier Code);
- Low Byte of the Error Code;

- High Byte of the Error Code;
- Low Byte of the Module Identifier's first word;
- High Byte of the Module Identifier's first word;
- ...
- ...
- Low Byte of the Module Identifier's sixteenth word;
- High Byte of the Module Identifier's sixteenth word.

**Operating Code %1**; the N568B/LC response to a Read Module Configuration is a group of 8 bit Bytes structured as follows:

- %01 (Low Byte of Master Identifier Code);
- %00 (High Byte of Master Identifier Code);
- Low Byte of the Error Code;
- High Byte of the Error Code;
- Low Byte of the Fine Gain Value word CH. 0;
- High Byte of the Fine Gain Value word CH. 0;
- Low Byte of the Pole Zero word CH. 0;
- High Byte of the Pole Zero word CH. 0;
- Low Byte of the Status Register word CH. 0;
- High Byte of the Status Register word CH. 0;
- Low Byte of the Fine Gain Value word CH. 1;
- ....
- ....
- High Byte of the Status Register word CH. 15;
- Low Byte of the Offset Value word;
- High Byte of the Offset Value word.

The Fine Gain Value and the Pole Zero can be %0 to %FF. The Status Register Word encodes on 7 bits the Coarse Gain Value, the Shape, the Output Polarity and the Output Configuration as shown in Fig. 4.1.

**Operating Code %2**; the N568B/LC response to a Read Offset Value is a group of 8 bit Bytes structured as follows:

- Low Byte of the Error Code;
- High Byte of the Error Code;
- Low Byte of the Offset Value word;
- High Byte of the Offset Value word.

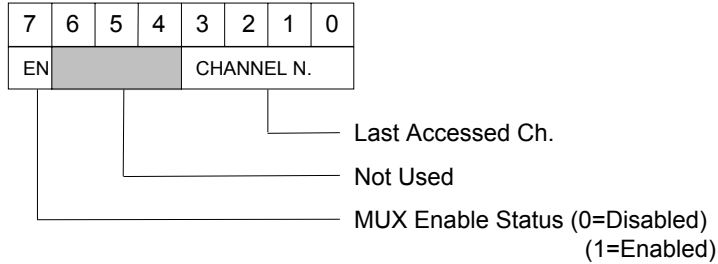
**Operating Code %3**; the N568B/LC response to a Read all Parameters for selected Channel is a group of 8 bit Bytes structured as follows:

- Low Byte of the Error Code;
- High Byte of the Error Code;
- Low Byte of the Fine Gain Value selected Channel;
- High Byte of the Fine Gain Value selected Channel;
- Low Byte of the Pole Zero selected Channel;
- High Byte of the Pole Zero selected Channel;
- Low Byte of the Status Register selected Channel;
- High Byte of the Status Register selected Channel.

**Operating Code %4;** the N568B/LC response to a Read MUX Enable Status & Last Accessed Channel is composed by 2 8-bit bytes structured as follows:

- Channel Number and MUX enable bit;
- Blank byte;

The byte containing Channel Number and MUX enable bit is structured as follows:



**Operating Codes %10 through %16;** the N568B/LC response to any of the 7 Set operations is the Error Code:

- Low Byte of the Error Code;
- High Byte of the Error Code.

### 4.11.1 Error Codes description

The Error Codes provided by the CAENET controllers are described in the following Table:

**Table 4.20: Error Codes**

Datum (Hex)	Meaning
%0	Successful operation.
%FF00	Module Busy; the Controller has tried to effect an operation while the module is setting the display brightness.
%FF01	Code not recognized or message incorrect.
%FF02	Value out of range.

### 4.11.2 Module Identifier Packet (response to code %0)

The response contains in the low byte the ASCII code of the string of characters identified by the name of the Module plus the version of the software running on the Main Controller.

**Table 4.21: Module Identifier Data Packet Structure**

Word	Contents	
	High byte 15..8	Low byte 7..0
2	0	"N"
3	0	"5"
4	0	"6"
5	0	"8"
6	0	" "
7	0	"V"
8	0	"e"
9	0	"r"
10	0	"s"
11	0	"i"
12	0	"o"
13	0	"n"
14	0	" "
15	0	"x"
16	0	":"
17	0	"x"