NIM354

**Network Module
in StackPC-PCI format**

User
Manual

Revision 1.4
December 2015

CE The product described in this manual is compliant
with all related CE standards.

Revision Record

Revision No	Brief description of changes	Board index	Revision date
1.0	Initial version	NIM354	September 2014
1.1	Figure "Power supply of NIM354 via XP1 connector from the PS352-01 power supply source" has been added (subsection 3.3.4).	NIM354	December 2014
1.2	Maximum weight, dimensions and power supply voltage information have been revised (para. 1.1), added link to the website http://www.stackpc.org/.	NIM354	January 2015
1.3	Note was made in subsection 3.3.4: The relevant power supply contacts (+5 V and GND) of XP12 connectors and stack connectors (XP13, XS2) are combined. Simultaneous connection of various power supply sources to stack connectors and XP12 connector is inadmissible.	NIM354	February 2015
1.4	Compliance assessment	NIM354	December 2015

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Notation Conventions

Warning!
ESD Sensitive Device!

This symbol draws your attention to the information related to electro static sensitivity of your product and its components. To keep product safety and operability it is necessary to handle it with care and follow the ESD safety directions.

Warning! Hot surface!

This sign marks warnings about touching the hot surfaces of the device.

Warning!

Information marked by this symbol is essential for human and equipment safety.
Read this information attentively, be watchful.

Note

This symbol and title marks important information to be read attentively for your own benefit.

Safety requirements

This product is designed and tested for the purpose of ensuring compliance with the electric safety requirements. Its design guarantees long-term failsafe operation. Life cycle of the device can be sufficiently reduced due to improper handling during unpacking and installation. Therefore, for your own safety and in order to ensure the proper operation of the device, you should observe the below recommendations.

High Voltage Safe Handling Rules

Warning!

All the works that involve this device should be carried out by the appropriately qualified personnel.

Warning, high voltage!

Before installing the board into the system make sure that the mains supply is switched off. This also applies to the installation of extension boards.

During installation, repairs and maintenance of the device there is a real danger of exposure to electric shock, therefore you should always disconnect the power supply feeding cable from the socket at the time of works. This also applies to the other power supply feeding cables.

Board Handling Regulations

ESD Sensitive Device!

Electronic boards and their components are sensible to static electricity. This is why you should give special attention to handling with these devices in order to ensure their integrity and working efficiency.

■ - Do not leave the board without protective packaging, when it is not operated.

■ - When applicable, always operate the board at the workplace equipped with protection against static electricity. If it is impossible, the user should remove a static discharge before touching the device by hand or using tools. The best way to do it is touch a metal part of system enclosure.

■ It is crucial to comply with safety precautions when disconnecting cables and extension boards, installing jumpers etc. Do not place the board on conducting surfaces such as antistatic mats and jaws. They could cause short-circuit and lead to damages of the board's conductive circuits.

General Board Operation Rules

- To keep the warranty, the product should not be altered or revised in any way. Any alterations or improvements not authorized by Fastwel LLC, except for those specified in this document or obtained from the technical support department of Fastwel LLC as a set of instructions for their implementation, cancel the warranty.

- This device should be installed and connected only to the systems, meeting all the necessary technical and climatic requirements. This above is also true to the operating temperature range of a particular version of the board.

- While performing all the required operations for installation and adjustment, please follow the instructions specified only in this document.

- Keep the original package for subsequent storage of the device and transportation in the warranty event. If it is necessary to transport or store the board, please pack it the same way as it was packed upon delivery.

- Exercise special care when unpacking and handling the device. Act in accordance with the instructions given above and in the paragraph 6 Transportation, unpacking and storage.

MANUFACTURER'S WARRANTIES

Warranty liabilities

The manufacturer guarantees that device's quality corresponds to the requirements of technical specification TU 4013-004-52415667-05 provided that the Consumer meets operation, storage, transportation and installation conditions and procedures, specified by accompanying documents.

The Manufacturer hereby guarantees that the products supplied thereby are free from defects in workmanship and materials, provided operation and maintenance norms were observed during the currently established warranty period. The Manufacturer's obligation under this warranty is to repair or replace free of charge any defective electronic component being a part of a returned product.

Products that broke down through the Manufacturer's fault during the warranty period will be repaired free of charge. Otherwise the Consumer will be invoiced as per the current labor remuneration rates and expendable materials cost.

Liability limitation right

The Manufacturer shall not be liable for the damage inflicted to the Consumer's property because of the product breakdown in the process of its utilization.

Warranty period

The warranty period for the products made by Fastwel LLC is 36 months from the date of sale (unless otherwise provided by the supply contract).

For customized products, the warranty period shall be
60 months from the date of sale (unless otherwise provided by the supply contract).

Limitation of warranty obligations

The above warranty obligations shall not be applied:

− To the products (including software), which were repaired or were modified by the employees, that do not represent the Manufacturer. Except for the cases when the Consumer performed repairs or made modifications to the device in strict adherence to the regulations, previously agreed and approved by the Manufacturer in writing;

− To the products, broken down due to unacceptable polarity reversal (to the opposite sign) of the power supply, improper operation, transportation, storage, installation, mounting or accident.

Procedure of device returning for repairs

Sequence of activities when returning the products for repairs:

− Apply to Fastwel company or to any of the Fastwel's official representatives for the Product Return Authorization;

− Attach a failure inspection report with a product to be returned in the form, accepted by the Manufacturer, with a description of the failure circumstances and symptoms;

− Carefully package the product in the antistatic bag and carton box, in which the product had been supplied. Failure to package in antistatic material will VOID all warranties.

− The customer pays for shipping the product to Fastwel or to an official Fastwel representative or dealer.

1   Introduction

NIM354 network module represents the board in StackPC-PCI form-factor and is an extension of the range of StackPC modules, manufactured by Fastwel Group (StackPC specification is provided at http://www.stackpc.org/). The device is designed for application in embedded systems for data acquisition and processing and operating in harsh environments. Modular architecture of the device enables to flexibly adjust the system for particular application areas, thereby optimizing the price/quality ratio.

NIM354 uses a high-speed multichannel Gigabit Ethernet I/O interface, with a possibility to support PoE (Power over Ethernet) - technology for provision of power supply over Ethernet data transfer lines (connection of up to four PoE devices).

Stability of NIM354 operation enables to use it in all industrial applications. Components used as the basis for NIM354, are carefully selected following applicability criteria in embedded systems, which makes the module an optimal solution for the systems with a long life cycle.

The User Manual contains directions for a proper and safe installation, powering-on and interaction of NIM354 with the extension modules or external devices.

For proper operation of the module within the specified service life it is required to previously look through the contents of this User Manual.

1.1   Main features of NIM354

- **Marvell 88E6176 network switch with seven Gigabit Ethernet channels:**
  - Second level of OSI model;
  - 4 LAN 10/100/1000 Mb/sec;
  - 2 LAN 1000 Mb/sec;
  - 1 MDI LAN 10/100/1000 Mb/sec (for NIM354-01 and NIM354-02 versions);
  - Auto-negotiation (automatic adjustment) via ports XP4, XP7, XP9 and XP11;
  - 1 Mb of the memory dynamic buffer;
  - Table for 8 000 MAC addresses with automatic learning and aging;
  - Compliance with the 802.3az Energy Efficient Ethernet standard;
  - QoS with support of IEEE 802.1p, IPv4, IPv6, 4096 VLAN IDs of 802.1Q standard.
- **PoE PSE Texas Instruments TPS23841 controller (for NIM354-01 and NIM354-03 versions):**
  - Compliance with the IEEE 802.3af standard;
  - Compliance with devices up to 25 W (where the power supply voltage is from 53 W);
  - Power supply voltage by A method.
- **PoE hardware monitor:**
  - Implemented on SMBus.
- **Indication:**
  - LED of SMI bus readiness;
  - LED of Ethernet StackPC activity;
  - Activity signals of other ports of the network switch are routed to the connector.

- **Weight, no more than:**
  - 90 g.
- **Dimensions, no more than:**
  - 96 mm × 96 mm x 23 mm
- **Power supply voltage:**
  - NIM354-01: +5 V ± 5% and +48 V (for PoE);
  - NIM354-02: +5 V ± 5%;
  - NIM354-03: +36 - 57 V.
- **Power supply range of PoE from 22 V to 57 V**
- **Maximum power consumption**
  - 6 W
- **MTBF, no less than:**
  - 500000 hours
- **Software compatibility of libraries for PoE:**
  - Windows XP (Embedded);
  - Linux 2.6;
  - QNX 6.5.

2 Technical specifications

2.1 Versions of NIM354

Versions of NIM354 and designation (ordering information) in product catalogs are specified in Table 2-1.

Table 2-1.:   **Parameters of NIM354 depending on module version**

Name	Conventional designation	Ordering designation	Note
Network Module NIM354	NIM354	NIM354-01	4 LAN 10/100/1000 Mb/sec with PoE, 2 LAN 1000 Mb/sec, 1 MDI LAN 10/100/1000 Mb/sec
		NIM354-02	4 LAN 10/100/1000 Mb/sec, 2 LAN 1000 Mb/sec, 1 MDI LAN 10/100/1000 Mb/sec
		NIM354-03	4 LAN 10/100/1000 Mb/sec with PoE, 2 LAN 1000 Mb/sec (without StackPC and PCI connectors)
		NIM354-01\ Coated	4 LAN 10/100/1000 Mb/sec with PoE, 2 LAN 1000 Mb/sec, 1 MDI LAN 10/100/1000 Mb/sec, coated
		NIM354-02\ Coated	4 LAN 10/100/1000 Mb/sec, 2 LAN 1000 Mb/sec, 1 MDI LAN 10/100/1000 Mb/sec, coated
		NIM354-03\ Coated	4 LAN 10/100/1000 Mb/sec with PoE, 2 LAN 1000 Mb/sec, (without StackPC and PCI connectors) coated

2.2   Delivery checklist of NIM354

Delivery checklist of NIM354 includes:

1.   NIM354 – 1 pcs.

2.   -

3.   Installation kit:

   a. Cable connector parts:

   ▪ Female plug WAGO p/n: 733-102 for XP12 connector – 1 pcs.

   ▪ Female plug WAGO p/n: 734-102 for XP1 connector – 1 pcs.

   ▪ Socket FCI p/n: 10073599-010LF for XP4, XP7-XP11 connectors – 6 pcs.

   ▪ Crimp contact FCI p/n: 77138-001LF for XP4, XP7 - XP11 connectors – 60 pcs.

   ▪ Socket Harwin p/n: m22-3011200 for XP5 connector – 1 pcs.

   ▪ Socket Harwin p/n: m22-3010300 for XP6 connector – 1 pcs.

   ▪ Crimp contact Harvin p/n: m22-3040042 for XP5, XP6 connectors – 15 pcs.

   ▪ Socket JST p/n: PHR-2 for XP2 connector – 1 pcs.

   ▪ Crimp contact JST p/n: SPH-002T-P0.5S for XP2 – 2 pcs.

   b. Jumper 2 mm TE Connectivity p/n 382575-2 for XP3 connector – 1 pcs.

4.   Packaging.

2.3   Packaging information

NIM354   is packaged in a box, which has the following overall dimensions: 155 x 140 x 45 mm.
Packaged weight of the module is no more than 0.25 kg.

Note

Retain the original antistatic and consumer packages of the module till the end of the guarantee service life period.

2.4   External view and location of components

The below figures will help you identify components, their configuration and functions. Module versions could have slight differences, not shown in diagrams and figures.

2.4.1   Location of main components and dimensions of NIM354

Location of connectors and main components of NIM354 with specification of overall dimensions is given in Fig. 2-1:
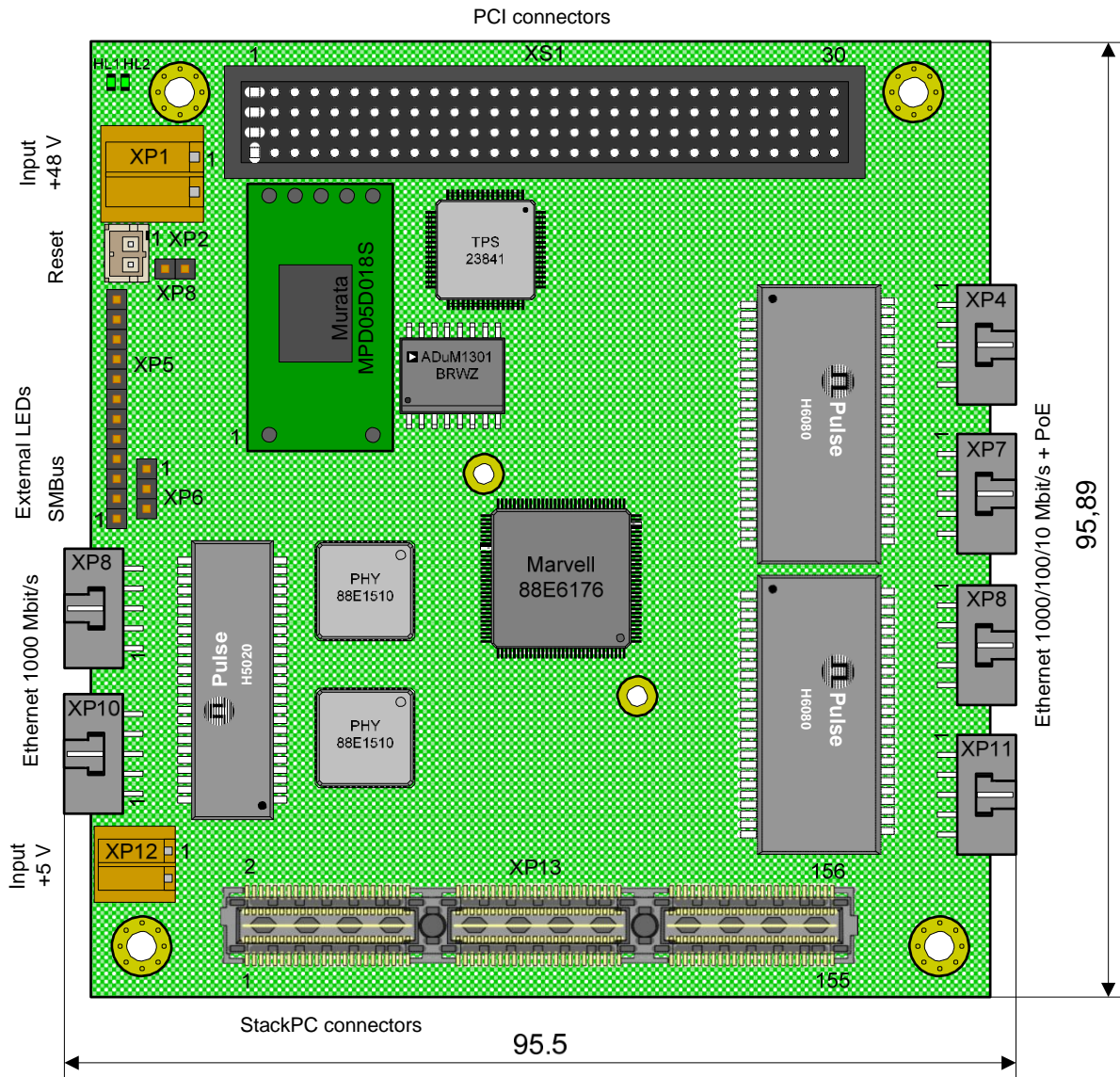
Fig. 2-1: Location of main components and dimensions of NIM354

This figure has a generalized picture of NIM354 (StackPC-PCI connectors are installed for NIM354-01 and NIM354-02 versions (see subsection 3.3.1); microchips TPS23841, ADUM1301 and MPD05D018S are soldered by manufacturer depending on module's version; for NIM354-03 there are vertical edge connectors (XP4, XP7, XP8, XP9, XP10, XP11), which are used instead of angular connectors (see subsection 3.3.2)).

2.5 System extension capabilities

For building systems with PoE support, an external power supply source for +48 V is required, and Fastwel PS352 power supply module can be used for this purpose (see User Manual for PS352).

Structure of PS352-01 makes it possible to connect it into stack (XP13 / XS2, XS1), not breaking it (see Fig. 3-10). For connection of +48 V power supply to NIM354 it is required to make a patch cable with connectors from among the delivery checklist of these modules.

3   Structure and operation of NIM354

3.1   Board layout

The figure below shows interaction of module's functional nodes (dash line marks the nodes that depend on module's version (see subsections 3.3.1 and 3.3.2):
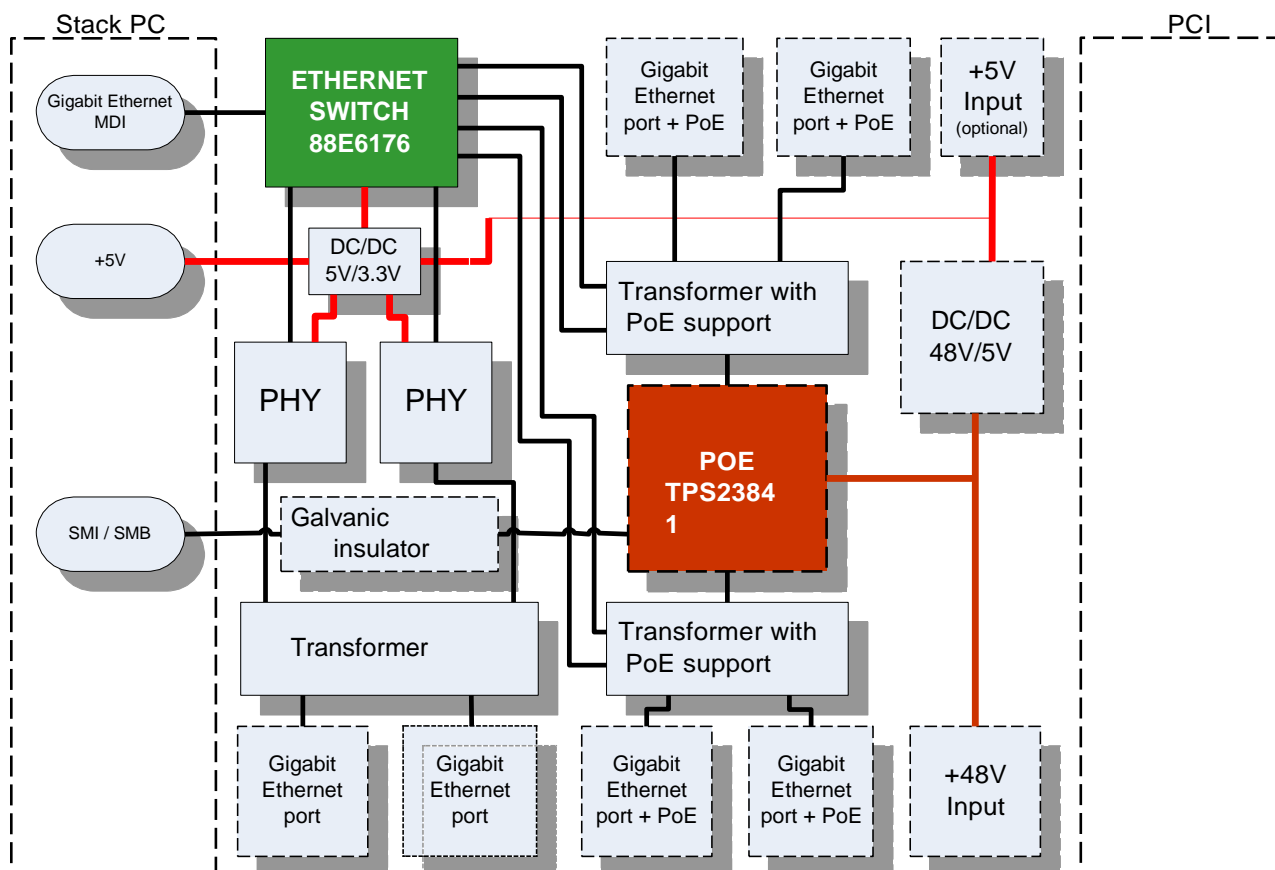
Рис. 3-1:   **Block diagram of NIM354**

3.2 Specifics of functional nodes operation

■ **Marvell Ethernet Switch 88E6176**

Low-power 7-port 1 Gigabit network switch with the Energy Efficient Ethernet (EEE) technology.
Key features:

- 1 Mb of outputs switching integrated memory;
- Maximum size of the package: up to 10 KB;
- Table for 8192 MAC addresses and table for all 4096 VLAN ID addresses.

■ **Texas Instruments PoE quad-port power sourcing TPS23841 (NIM354-01 and NIM354-03 versions)**

4-port PoE power supply controller with integrated keys and current regulators. Input operating voltage from 22 V to 57 V Compliance with the IEEE 802.3af standard. High output power of the ports (up to 25 W) enables to connect devices from 0 to 4 class. I^{2}C bus makes it possible to control the state of each port and read such a state (detection, classification in real time of operating current and voltage).

■ **Reset of network switch settings**

Reset signal is shaped from the following sources:

- from CPU module within StackPC system (in case of the installed XP3 jumper, see Fig. 2-1);
- from XP2 connector (see Fig. 2-1).

■ **Power supply**

- +5 V ± 5% either from XP12 connector or from StackPC XP13 / XS2 connector (simultaneous connection of power supply of +5 V to the XP12 connector and stack connectors is not allowed);
- +36 - 57 V from XP1 connector.

3.3   Module interfaces

3.3.1   StackPC connector

NIM354 is designed in accordance with the StackPC-PCI specification: XS1 - connector of PCI interface, XP13 and XS2 StackPC connectors (location of XS1 and XP13 connectors is shown in Fig. 2-1). The specified connectors are installed for NIM354-01 and NIM354-02 versions, designed for the use in stack systems, however the module also performs its functions as to its other system architecture versions.
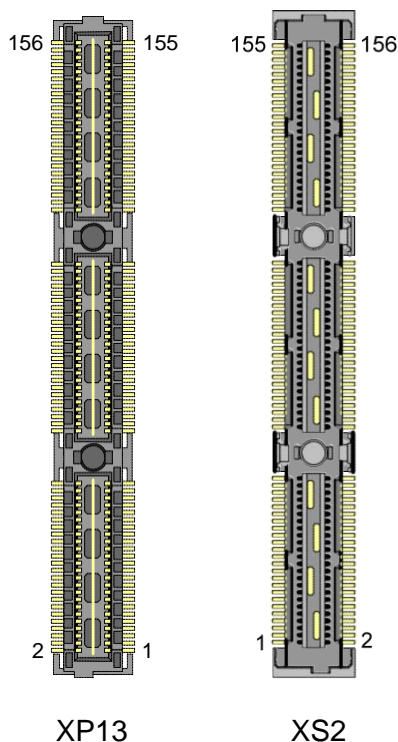
XS2 connector is located under XP13 on the reverse side of the module.

XP13   XS2

Fig. 3-2:   StackPC XP13 and XS2 connectors

3.3.1.1 Purpose of StackPC XP13 and XS2 connectors contacts

MDI Ethernet Port 0 from XS2 is connected to the network switch and Port 1 is shifted and is connected to the location of the Port 0 in XP13, in accordance with the StackPC-PCI specification. The other interface signals between the connectors are connected in such a way, which will ensure stack continuity.

Green LED HL2 (see Fig. 2-1) is on, if 0 port is connected.

Ethernet MDI Interface
SMBus Interface
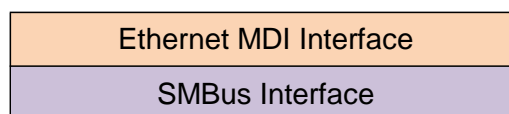
Fig. 3-3:   Color code designation of the used interfaces

Table 3-1.:   **Purpose of XP13 and XS2 connectors contacts**

External connector XP13						Lower connector XS2				
No	Signal		Signal	No		No	Signal		Signal	No
1	USB_OC#		PE_RST#	2		2	PE_RST#		USB_OC#	1
3	+3.3V		+3.3V	4		4	+3.3V		+3.3V	3
5	USB_1p		USB_0p	6		6	USB_0p		USB_1p	5
7	USB_1n		USB_0n	8		8	USB_0n		USB_1n	7
9	GND		GND	10		10	GND		GND	9
11	PEx1_1Tp		PEx1_0Tp	12		12	PEx1_0Tp		PEx1_1Tp	11
13	PEx1_1Tn		PEx1_0Tn	14		14	PEx1_0Tn		PEx1_1Tn	13
15	GND		GND	16		16	GND		GND	15
17	PEx1_2Tp		PEx1_3Tp	18		18	PEx1_3Tp		PEx1_2Tp	17
19	PEx1_2Tn		PEx1_3Tn	20		20	PEx1_3Tn		PEx1_2Tn	19
21	GND		GND	22		22	GND		GND	21
23	PEx1_1Rp	BANK1 (+5V)	PEx1_0Rp	24		24	PEx1_0Rp	BANK1 (+5V)	PEx1_1Rp	23
25	PEx1_1Rn		PEx1_0Rn	26		26	PEx1_0Rn		PEx1_1Rn	25
27	GND		GND	28		28	GND		GND	27
29	PEx1_2Rp		PEx1_3Rp	30		30	PEx1_3Rp		PEx1_2Rp	29
31	PEx1_2Rn		PEx1_3Rn	32		32	PEx1_3Rn		PEx1_2Rn	31
33	GND		GND	34		34	GND		GND	33
35	PEx1_1Clkp		PEx1_0Clkp	36		36	PEx1_0Clkp		PEx1_1Clkp	35
37	PEx1_1Clkn		PEx1_0Clkn	38		38	PEx1_0Clkn		PEx1_1Clkn	37
39	+5V_SB		+5V_SB	40		40	+5V_SB		+5V_SB	39
41	PEx1_2Clkp		PEx1_3Clkp	42		42	PEx1_3Clkp		PEx1_2Clkp	41
43	PEx1_2Clkn		PEx1_3Clkn	44		44	PEx1_3Clkn		PEx1_2Clkn	43
45	DIR		PWRGOOD	46		46	PWRGOOD		DIR	45
47	SMB_DAT		PE_x4_CLKp	48		48	PE_x4_CLKp		SMB_DAT	47
49	SMB_CLK		PE_x4_CLKn	50		50	PE_x4_CLKn		SMB_CLK	49
51	SMB_ALERT#		PSON#	52		52	PSON#		SMB_ALERT#	51
53	STK0/WAKE#		STK1/SATA_ACT	54		54	STK1/SATA_ACT#		STK0/WAKE#	53
55	Type_DETECT#		GND	56		56	GND		Type_DETECT#	55
57	ETH_1_MDI(0)p		PEx4_0T(0)p	58		58	PEx4_0T(0)p		ETH_0_MDI(0)p	57
59	ETH_1_MDI(0)n		PEx4_0T(0)n	60		60	PEx4_0T(0)n		ETH_0_MDI(0)n	59
61	GND	BANK2 (+5V)	GND	62		62	GND	BANK2 (+5V)	GND	61
63	NC		PEx4_0T(1)p	64		64	PEx4_0T(1)p		ETH_1_MDI(0)p	63
65	NC		PEx4_0T(1)n	66		66	PEx4_0T(1)n		ETH_1_MDI(0)n	65
67	GND		GND	68		68	GND		GND	67
69	ETH_1_MDI(1)p		PEx4_0T(2)p	70		70	PEx4_0T(2)p		ETH_0_MDI(1)p	69
71	ETH_1_MDI(1)n		PEx4_0T(2)n	72		72	PEx4_0T(2)n		ETH_0_MDI(1)n	71
73	GND		GND	74		74	GND		GND	73

No	Signal	BANK	Signal	No
External connector XP13				
75	NC		NC	76
77	NC		NC	78
79	NC		ETH_1_LINK_AC	80
81	SATA_T1p		SATA_T0p	82
83	SATA_T1n		SATA_T0n	84
85	GND	BANK2 (+5V)	GND	86
87	USB_3p		USB_2p	88
89	USB_3n		USB_2n	90
91	GND		GND	92
93	USB_5p		USB_4p	94
95	USB_5n		USB_4n	96
97	GND		GND	98
99	NC		ETH_1_CTREF	100
101	SPI_SS0#		SPI_MOSI	102
103	SPI_SS1#		SPI_MISO	104
105	STK2/SPI_SCK		LPC_CLK	106
107	SPI_SS2#		GND	108
109	ETH_1_MDI(2)p		PEx4_0R(0)p	110
111	ETH_1_MDI(2)n		PEx4_0R(0)n	112
113	GND		GND	114
115	NC		PEx4_0R(1)p	116
117	NC		PEx4_0R(1)n	118
119	GND		GND	120
121	ETH_1_MDI(3)p		PEx4_0R(2)p	122
123	ETH_1_MDI(3)n		PEx4_0R(2)n	124
125	GND		GND	126
127	NC	BANK3 (+12V)	PEx4_0R(3)p	128
129	NC		PEx4_0R(3)n	130
131	PE_PRSNT1#		PE_PRSNT0#	132
133	SATA_R1p		SATA_R0p	134
135	SATA_R1n		SATA_R0n	136
137	GND		GND	138
139	FBUS_1p		FBUS_0p	140
141	FBUS_1n		FBUS_0n	142
143	GND		GND	144
145	LPC_AD0		LPC_DRQ#	146
147	LPC_AD1		LPC_SERIRQ#	148
149	GND		GND	150
151	LPC_AD2		LPC_FRAME#	152
153	LPC_AD3		RTC_Battery	154
155	FBUS_1RTS#		FBUS_0RTS#	156

No	Signal	BANK	Signal	No
Lower connector XS2				
76	PEx4_0T(3)p		ETH_1_MDI(1)p	75
78	PEx4_0T(3)n		ETH_1_MDI(1)n	77
80	ETH_0_LINK_ACT#		ETH_1_LINK_ACT#	79
82	SATA_T0p		SATA_T1p	81
84	SATA_T0n		SATA_T1n	83
86	GND	BANK2 (+5V)	GND	85
88	USB_2p		USB_3p	87
90	USB_2n		USB_3n	89
92	GND		GND	91
94	USB_4p		USB_5p	93
96	USB_4n		USB_5n	95
98	GND		GND	97
100	ETH_0_CTREF		ETH_1_CTREF	99
102	SPI_MOSI		SPI_SS0#	101
104	SPI_MISO		SPI_SS1#	103
106	LPC_CLK		STK2/SPI_SCK	105
108	GND		SPI_SS2#	107
110	PEx4_0R(0)p		ETH_0_MDI(2)p	109
112	PEx4_0R(0)n		ETH_0_MDI(2)n	111
114	GND		GND	113
116	PEx4_0R(1)p		ETH_1_MDI(2)p	115
118	PEx4_0R(1)n		ETH_1_MDI(2)n	117
120	GND		GND	119
122	PEx4_0R(2)p		ETH_0_MDI(3)p	121
124	PEx4_0R(2)n		ETH_0_MDI(3)n	123
126	GND		GND	125
128	PEx4_0R(3)p	BANK3 (+12V)	ETH_1_MDI(3)p	127
130	PEx4_0R(3)n		ETH_1_MDI(3)n	129
132	PE_PRSNT0#		PE_PRSNT1#	131
134	SATA_R0p		SATA_R1p	133
136	SATA_R0n		SATA_R1n	135
138	GND		GND	137
140	FBUS_0p		FBUS_1p	139
142	FBUS_0n		FBUS_1n	141
144	GND		GND	143
146	LPC_DRQ#		LPC_AD0	145
148	LPC_SERIRQ#		LPC_AD1	147
150	GND		GND	149
152	LPC_FRAME#		LPC_AD2	151
154	RTC_Battery		LPC_AD3	153
156	FBUS_0RTS#		FBUS_1RTS#	155

3.3.2   Gigabit Ethernet interface with PoE

In addition to the port with Ethernet MDI interface in XS2 StackPC connector, 4 more 10/100/1000Base-T port and 2 1000Base-T Ethernet ports are routed to the edge angular XP4, XP7, XP8, XP9, XP10, XP11 connectors. Switching of these ports is carried out on the basis of microchip of Marvell Ethernet Switch 88E6176 and 2 Marvell PHY 88E1510 switches. Controller's architecture is optimized to achieve high speed switching at minimum power consumption.

For NIM354-03 version there are vertical edge connectors installed instead of the angular ones (XP4, XP7, XP8, XP9, XP10, XP11), which makes it possible to route interfaces without the use of cables to the switching board with enclosure connectors.

The interfaces ensure automatic determination of transfer rate and switching between data transfer modes 10Base-T, 100Base-TX and 1000Base-T.

The edges of NIM354 are equipped with six Gigabit Ethernet ports. Depending on module version, the 4 of them (XP4, XP7, XP9, XP11) have the supplied power PoE (see subsection 3.3.2.3).

Fig. 3-4:   **External view of Ethernet interface connector**

Warning!

XP8 and XP10 connectors operation is available only in the 1000Base-T mode.

3.3.2.1 Purpose of RJ45 connector contacts

The connectors makes it possible to use 10Base-T, 100Base-TX and 1000Base-T interfaces in stack systems.

Table 3-2.:   **Purpose of Gigabit Ethernet connectors contacts**

Contact	Data transfer standard						Power supply PoE (XP4, XP7, XP9,	
	10Base-T		100Base-TX		1000Base-T		Method A	Method B
	I/O	Signal	I/O	Signal	I/O	Signal		
1	O	TX+	O	TX+	I/O	BI_DA+	DC +	–
2	O	TX –	O	TX –	I/O	BI_DA–	DC +	–
3	I	RX +	I	RX +	I/O	BI_DB+	DC –	–
4	–	–	–	–	I/O	BI_DC+	–	DC +
5	–	–	–	–	I/O	BI_DC–	–	DC +
6	I	RX –	I	RX –	I/O	BI_DB–	DC –	–
7	–	–	–	–	I/O	BI_DD+	–	DC –
8	–	–	–	–	I/O	BI_DD–	–	DC –
9	–							
10	–							

Connection and operation activity over each Ethernet port is routed to the relevant contacts on XP5 connector.

Power supply PoE is implemented using the Method A and is described below.

3.3.2.2 XP5 connector of state LEDs of Ethernet channels

Table 3-3.:   **Purpose of XP5 contacts**

Contact number	Signal	Input/Output
1	LED_P3_LED0	Out
2	LED_P5_LED0	Out
3	LED_FLOW	Out
4	LED_P4_LED0	Out
5	LED_P2_LED0	In
6	LED_P1_LED0	In
7	LED_P0_LED0	In
8	P5_LINK	In
9	P5_ACTIV	In
10	P6_LINK	In
11	P6_ACTIV	In
12	LED_GND	Out

Diagram of state LEDs of Ethernet channels is given below.

The diagram is designed for LEDs with a voltage drop of 2 V and luminance current < 5 mA.

Table 3-4: Compliance of LEDs with Ethernet ports

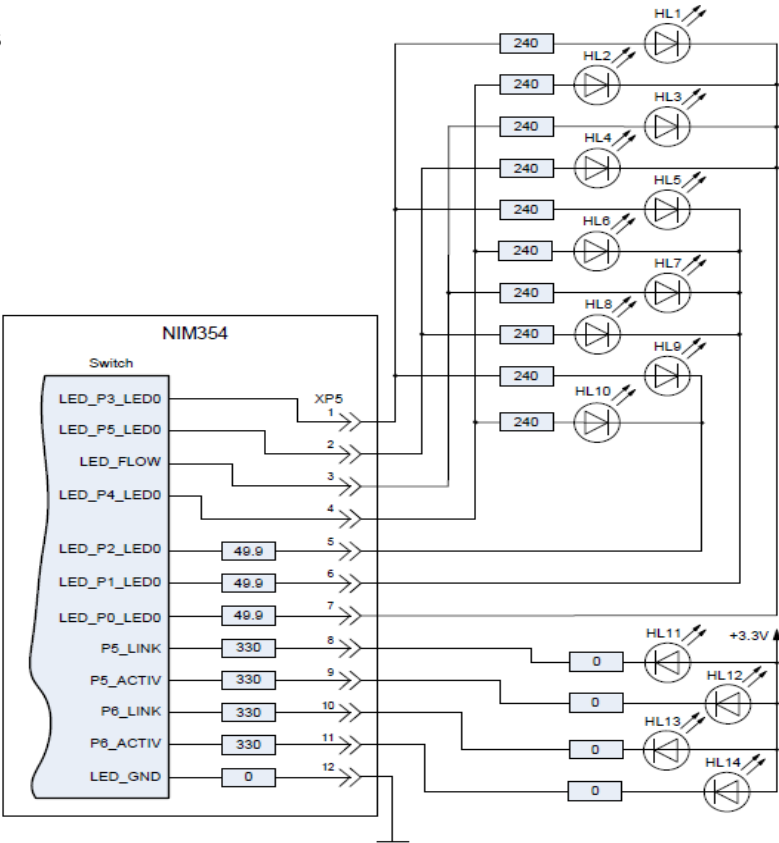| Port number	LED and its functionality
0	HL1 – Link/Activity
	HL2 – Gigabit Link
1	HL3 – Link/Activity
	HL4 – Gigabit Link
2	HL5 – Link/Activity
	HL6 – Gigabit Link
3	HL7 – Link/Activity
	HL8 – Gigabit Link
4	HL9 – Link/Activity
	HL10 – Gigabit Link
5	HL11 – Link/Activity
	HL12 – 100/1000 Mbps Link
6	HL13 – Link/Activity
	HL14 – 100/1000 Mbps Link

Fig. 3-5:   **Example of LEDs connection diagram**

This combination of LEDs corresponds to the basic switch setting. Link/Activity functionality – operation, activity; LED is on if there is Ethernet connection on the relevant port and flashes, if this port is used for receipt and sending of packages by the switch. Gigabit Link LED is on when connecting 1000Base-T interface via this port.

HL12, HL14 LEDs on 5 and 6 ports are on in case of connection to 100 Mbps, however the port itself operates only at the speed of 1000 Mbps.

3.3.2.3   PoE power supply

This technology, together with data, enables transferring power supply to a remote device via 2 twisted-pair wires in accordance with the IEEE 802.3af standard, using the method A. This standard assumes supplying power to the devices with a voltage from 44 V to 57 V, therefore, if the external PoE device used does not allow deviations from the standard and lesser power supply nominal value, XP1 should be supplied with a voltage not less than 44 V, although the PoE controller integrated into the module, can operate using from 22 V.

Warning!

The used controller enables to connect more powerful devices of IEEE 802.3at standard (4-th class), but loading them at full capacity (up to 25 W for a port) is possible only on the condition that they are operated using the voltage of no less than 53 V.
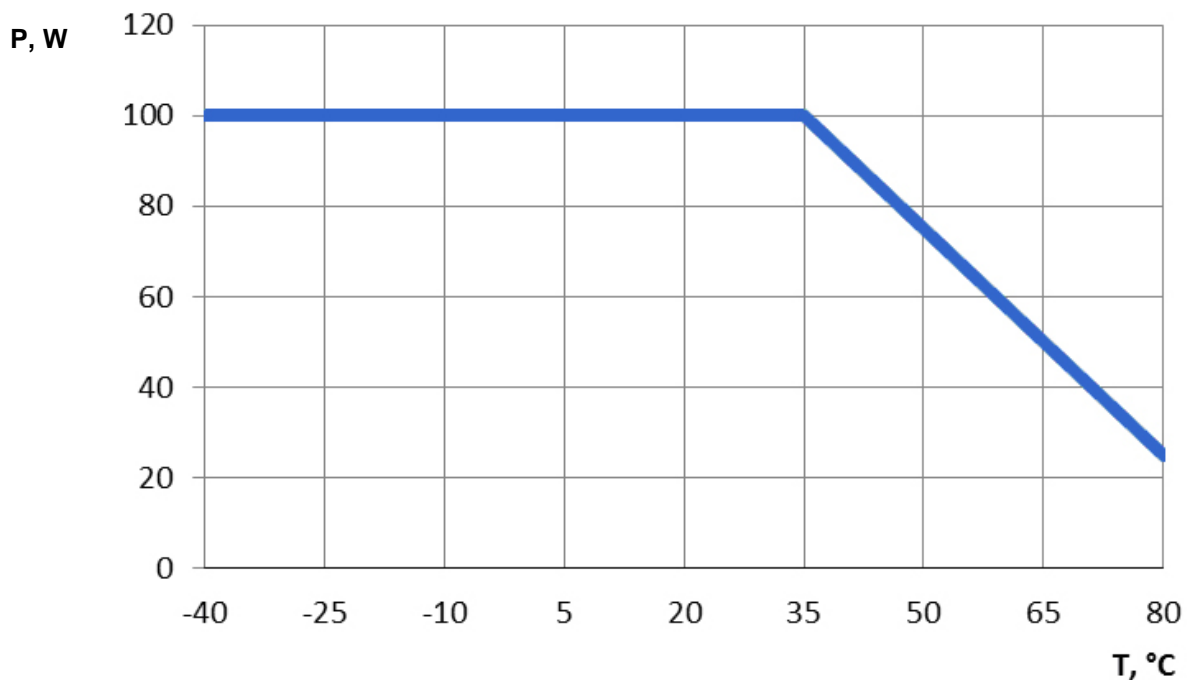
Fig. 3-6:   **Dependence of the maximum total load to all ports on the ambient temperature**

Note

When connecting devices that require higher power consumption, particular consideration should be given to heat removal from the module and interrelation of maximum total load and ambient temperature.

Operation of PoE microchip of the controller (TPS23841) can be carried out under control over SMBus from StackPC connector, or over I^2C via XP6 connector (only for NIM354-03 version).

Table 3-5.:   **Purpose of XP6 connector contacts**

Contact number	Signal	Purpose for NIM354-01, -02	Purpose for NIM354-03	Input/Output
1	MDIO	SMI Data	I^2C Data	In/Out
2	GND	GND	GND	In
3	MDC	SMI Clock	I^2C Clock	In

This connector enables to connect to Serial Management Interface   (SMI) of switch microchip and gain access directly to its registers (only for NIM354-01 and NIM354-02 versions). For more information, please contact technical support of Fastwel Group.

For various operating systems (OS), drivers and utility programs are supplied for control of PoE microchip TPS23841 of NIM354-01 over SMBus of CPC309 or CPC805 CPU modules (manufactured by Fastwel Group) within the StackPC system.

A.   Control in Linux 2.6 OS

Control is carried out via write/read from controller registers (for more detailed information see documentation for TPS23841). PoE.sh script demonstrates operation with device driver.

PoE.sh *[port number] [command]*

Numbers of the ports: 1, 2, 3, 4 or all in case when a command refers to all the ports.

Commands:

status – displays information on the port's status;
sensors or **sensor** – displays values of sensors in the table;
disable – disables a port;
enable – enables a port;
reset – reset and start of POR cycle of all the ports;
shutdown or **turnoff**, or **poweroff** – disconnects power supply of all the ports;
poweron or **turnon** – turns on the power supply of all the ports;
acoff, aclow, achigh – control of AC mode.

Example:

 # ./PoE.sh 1 status
 # ./PoE.sh 2 sensors
 # ./PoE.sh all reset
 # ./PoE.sh all achigh

B.   Control in QNX 6.5.

Control is carried out by using the following commands:

Single display of current parameters:
 # poe-tps23841 -v
Common=0x00: Ports no fault
Port #0 status 0x0180: [Fault status is no faults | Class ID is 0 | Discovery status is fail | WDT is not active | A/D status is not active | Function done is normal | Function status is searching]
Port #0 Discovery Current=0x112: 44.918 [mA]
Port #0 Voltage=0x00: - [V]
Port #0 Current=0x00: - [mA]
Port #1 status 0x0A50: [Fault status is no faults | Class ID is 2 | Discovery status is normal | WDT is not active | A/D status is active (conversion in process) | Function done is complete (self clearing by a new function write) | Function status is power delivery]
Port #1 Discovery Current=0x505: 210.656 [mA]
Port #1 Voltage=0x418E: 47.541 [V]

Port #1 Current=0x865: 59.022 [mA]
Port #2 status 0x0180: [Fault status is no faults | Class ID is 0 | Discovery status is fail | WDT is not active | A/D status is not active | Function done is normal | Function status is searching]
Port #2 Discovery Current=0x114: 45.246 [mA]
Port #2 Voltage=0x00: - [V]
Port #2 Current=0x00: - [mA]
Port #3 status 0x0A60: [Fault status is no faults | Class ID is 4 | Discovery status is normal | WDT is not active | A/D status is active (conversion in process) | Function done is complete (self clearing by a new function write) | Function status is power delivery]
Port #3 Discovery Current=0x445: 179.180 [mA]
Port #3 Voltage=0x41C2: 47.688 [V]
Port #3 Current=0x1D9: 12.991 [mA]

Multiple display of parameters with a period of 1 sec.:
 # poe-tps23841 -v -w

All ports are on:
 # poe-tps23841 -v -c on
All port turned on

All ports are off:
 # poe-tps23841 -v -c off
All port turned off

All ports are reseted:
 # poe-tps23841 -v -c reset
All port reseted

Port disable, as an example port#1 is used:
 # poe-tps23841 -v -p1 -c disable
Port#1 disable

Port enable, as an example port#1 is used:
 # poe-tps23841 -v -p1 -c enable
Port#1 enable

Other options:

Disable of AC of the port mode, as an example port#1 is used:
 # poe-tps23841 -v -p1 -c ac_off

Enable of AC HI of the port mode, as an example port#1 is used:
 # poe-tps23841 -v -p1 -c ac_high

Enable of AC LOW of the port mode, as an example port#1 is used:
 # poe-tps23841 -v -p1 -c ac_low

C.   Control in Windows XP (Embedded).
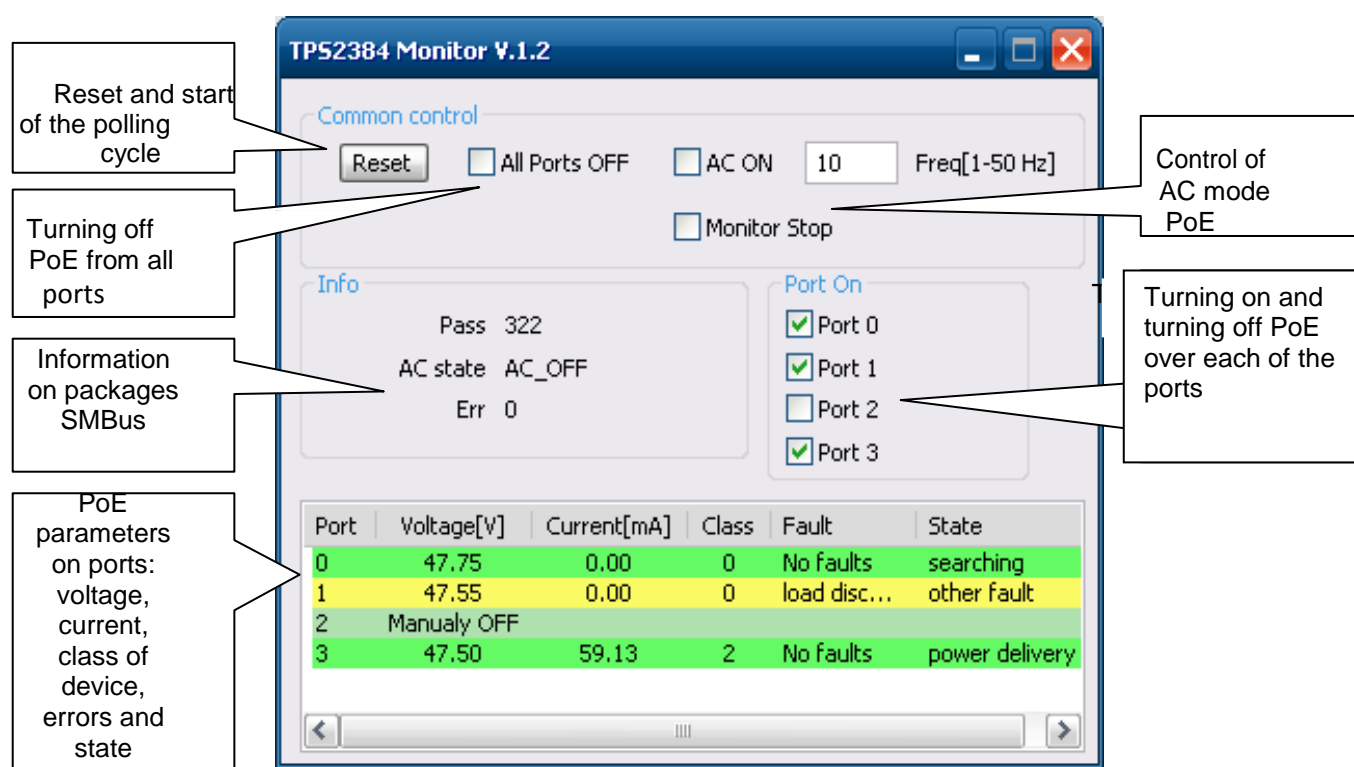
For this OS, TPS2384monitor.exe utility is supplied.

Fig. 3-7:   Description of the dialog box of operation with PoE

For stable operation of AC mode it is required to activate "MonitorStop" that disables monitoring of data related to the operation of PoE.

3.3.3   HL1 and HL2 LEDs

NIM354 is equipped with two green LEDs: HL1 and HL2, which operation is described in the table below:

Table 3-6.:   Purpose and functions of HL1 and HL2 LEDs

Color labeling	Purpose	Color	Function
HL1	Indicator of switch microchip operation readiness.	Green	The LED is on after data load EEPROM and SMI bus readiness.
HL2	Indicator LINK Ethernet from StackPC connector.	Green	The LED is on after connection with other Ethernet port via stack connector.

3.3.4   Power supply connectors

Module power supply should correspond to the requirements, specified in para. 1.1.

Power supply +5 V can be carried out both through XP12 connector and StackPC connectors. Maximum consumption current value of the module is 0.8 A, not including the connected external devices.

For connection of power supply via XP12, Wago 733-102 power supply female plug (included into the delivery checklist) is used.
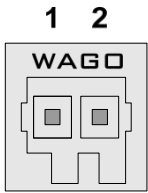
Fig. 3-8:   **XP12 power supply connector**

Table 3-7.:   **Purpose of XP12 connector contacts**

Contact number	Signal
1	+5 V
2	GND

Warning!

The relevant power supply contacts (+5 V and GND) of XP12 connectors and stack connectors (XP13, XS2) are combined.

Simultaneous connection of various power supply sources to stack connectors and XP12 connector is not permissible.

Connection of power supply +48 V (for power supply of the module itself and PoE system) to the module is carried out only via XP1 connector. Maximum consumption current value 0.12 A, not including the connected external devices.
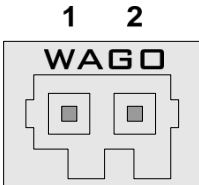
Fig. 3-9:   **XP1 power supply connector**

Table 3-8.:   **Purpose of XP1 connector power supply contacts**

Contact number	Signal
1	+48 V
2	GNDA

For connection of power supply via XP1, Wago 734-102 power supply female plug (included into the delivery checklist) is used.

The use of the Fastwel PS352 power supply module was already mentioned in subsection 2.5. The figure below shows NIM354 ready-fitted with the PS352-01 power supply module. Using a separate cable (the user can manufacture it independently, using the supplied sockets), power is supplied from Wago female plug of PS352-01 module to XP1 connector of NIM354 module.

Fig. 3-10:   **Power supply of NIM354 via XP1 connector from the PS352-01 power supply source**

4   Installation

When installing NIM354 network module into StackPC-PCI connectors, it is necessary to strictly follow the below rules, warnings and procedures in order to properly install the module, avoiding damages to the device, system components, as well as injures to the staff.
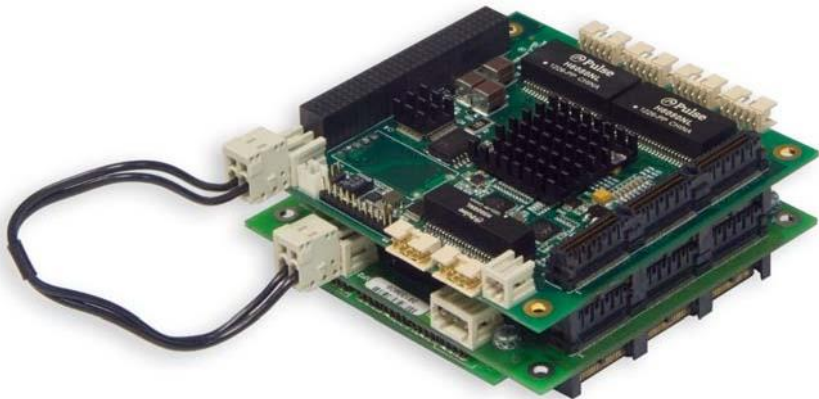
4.1   Safety requirements

When handling NIM354 strictly follow the below safety requirements. Manufacturer shall not be liable for any damages, arising out as a result of non-observance of such requirements.

Warning!

Be careful when handling the module, since the cooling heatsink can become too hot.

Moreover, the module should not be placed on any surface or put in any container until both module and heatsink will have the room temperature.

Warning!

Turn off the system power supply before installation / removal of the module. Violation of this rule can pose a threat for your health and life, as well as could lead to system or module damages.

Electrostatic Sensitive Device (ESD)!

Module contains components sensible to static electricity. In order to prevent module damages, observe the following precaution measures:

- Before touching the module, discharge the static electricity from your clothes, as well as from the tools before using them.
- Do not touch electronic components and connector contacts.
- If you have a professional workplace equipped with antistatic protection, don't forget to use it.

4.2   Installation of NIM354-01 and NIM354-02 versions

StackPC-PCI connectors (location of XS1 and XP13 connectors is shown in Fig. 2-1) makes it possible to install NIM354-01 and NIM354-02 versions (see subsection 3.3.1) into StackPC-PCI stack.

In this case, NIM354-01 and NIM354-02 modules should be fastened within the stack.

Example of NIM354 module ready-fitted with the PS352-01 power supply module is shown in Fig. 3-10.

In case of the increased mechanical loads, NIM354-01 and NIM354-02 modules should be fixed by metal legs. The legs are fastened using mounting holes of the modules.

4.3   Installation of NIM354-03

NIM354-03 module (it has no StackPC-PCI connectors) is designed for the use in the systems that are not meant to be installed into stack.

Module's installation is carried out with the use of fixing elements (legs), mounting holes on the board are used for this purpose.

5   Additional information

5.1   Power consumption of NIM354

The board uses power supply voltages of +5 V from the XP12 connector and + 48 V from XP1.

Consideration should be given to certain requirements, which are essential for ensuring stability and reliability. The tables below contain values of the maximum allowable voltages on power lines, which if exceeded, could lead to module damages. Power supply sources, which are to be used with NIM354, should be checked in order to meet these requirements.

Table 5-1.:   Maximum allowed power supply voltages of NIM354-01

Power supply voltage	Maximum allowable value
+5 V	from +4,5 V to +5,5 V
+48 V	from +36 V to +57 V

Table 5-2.:   Maximum allowed power supply voltages of NIM354-02

Power supply voltage	Maximum allowable value
+5 V	from +4,5 V to +5,5 V

Table 5-3.:   Maximum allowed power supply voltages of NIM354-03

Power supply voltage	Maximum allowable value
+48 V	from +36 V to +57 V

The table below determines operating range of module's power supply voltage. If power supply voltage exceeds the specified limits, module functionality is not guaranteed.

Table 5-4.:   Operating range of power supply voltages of NIM354

Power supply voltage	Recommended value
+5 V	from +4,75 V to +5,25 V

Power consumption of NIM354 (not including power supply of external circuits) does not exceed the values, specified in the table:

Table 5-5.:   Consumption current of NIM354

Module type	Consumption current, in A, no more than	
	+5 V	+48 V
NIM354-01	0.8	0.03
NIM354-02	0.8	—
NIM354-03	—	0.12

5.2   Compliance with safety requirements

NIM354 corresponds to the general safety requirements imposed on IT equipment according to the GOST R IEC 60950-2002.

5.3   Noise resistance of NIM354

NIM354 corresponds to resistance requirements to IT equipment against electromagnetic interference according to the GOST R 51318.24-99 standard (CISPR 24-97).

NIM354 corresponds to the requirements for the level of industrial RF interferences coming from It equipment in accordance with the GOST R 51318.22-99 (CISPR 22-97).

5.4   Operation conditions

The device retains operability under the following climatic and mechanical effects:

Table 5-6.:   **Parameters of climatic and mechanical effects**

Type of effect	Parameter name	Parameter value	Document
Temperature change (at relative humidity up to 80 %, without moisture condensation)	Low temperature	- 40°C	GOST 28209-89 (IEC 68-2-14-84)
	High temperature	+ 85°C[1]	
Sinusoidal vibration	Range of frequencies (Hz)	10...500	GOST 28203-89 (IEC 68-2-6-82)
	Acceleration, g	5	
Single shocks	Peak acceleration, g	100	GOST 28213-89 (IEC 68-2-27-87)
Multiple shocks	Peak acceleration, g	50	GOST 28215-89 (IEC 68-2-29-87)
	Number of shocks	1000	

---

[1] NIM354-01 and NIM354-03 modules are the ambient temperature of +85°C and natural convection, allow connection of PoE devices with a total power of no more than 20 W. Maximum permissible total power to all the ports under various temperature operating conditions, can be obtained from the diagram in Fig. 3-6.

6   Transportation, unpacking and storage

6.1   Transportation

The module should be transported in a separate packaging box (transport packaging) of the manufacturing facility, which consists of an individual antistatic bag and a cardboard box, in the closed transport (automobile, railway, air transportation in heated and pressurized compartments) in storage conditions 5 defined in the GOST standard 15150-69 (IEC 721-2-1 standard) or in storage conditions 3 during sea transportation.

It is possible to transport modules, packaged in individual antistatic packages, in multiple packaging (transport packaging) of the manufacturing facility.

The packaged modules should be transported in accordance with the shipping rules, operating with this particular type of transport.

During handling and transportation operations, the packaged modules should not undergo sharp pounding, falls, shocks and exposure to atmospheric precipitation. The packaged modules should be stored in a carrier vehicle in such a manner which will prevent their moving.

6.2   Unpacking

Prior to unpacking, before transportation at subzero temperature of ambient air the modules should be kept within 6 hours under storage conditions 1 defined in the GOST standard 15150-69 (IEC 721-2-1 standard).

It is prohibited to place the packaged module close to the heat source, prior to unpacking.

While unpacking, it is required to comply with all safety precautions, which ensure its safety, as well as marketable condition of consumer packaging of the manufacturing company.

At the time of unpacking it is required to check the module that it has no external mechanical damages after transportation.

6.3   Storage

Module storage conditions for group 1 are defined in the GOST standard 15150-69 (IEC 721-2-1 standard).

ANNEX B   # DISCLAIMER

This Disclaimer contains special operating conditions of Fastwel in the following areas: intellectual property, warranty policy, conditions of the order and delivery.

1 INTELLECTUAL PRORETY

1.1 If any infraction, interference, improper use, illegitimate exploitation and/or violation of the industrial and/or intellectual property rights of any third party and/or property, exploitation during the use of Fastwel Embedded Module will take place – Fastwel does not guarantee to replace the materials, computer programs, procedures or equipment affected by the complaint and under no circumstances doesn't bear responsibility in any form for possible refusal in case of such a replacement.

1.2 Use of the Fastwel products as well as the objects of intellectual property containing in them, in the ways and for the purposes, not provided by the present user manual and datasheet isn't allowed without preliminary written approval of Fastwel.

1.3 Fastwel is not responsible for possible incidents and losses, related to the operation of end devices, in which the original Fastwel equipment is used.

2 WARRANTY POLICY

2.1 When the detected flaws in an element can be corrected without decreasing the foreseen technical features and functionality for it, User may demand Fastwel the urgent correction of the failures in additionally agreed period and an increasing of the period of the guarantee of the element equal as the time elapsed from the formal request to repair the failures, until the receipt of the repaired element. All costs associated to the correction of failures, included those of assembly, dismantle, transport, tests, etc, if they exist, shall be prosecuted according the Warranty Policy of Fastwel.

3 ORDER AND DELIVERY CONDITIONS

3.1 The general rule is that all Fastwel equipment prices are determined with due consideration of delivery under the EXW terms and conditions (Incoterms 2010). Delivery of the products under other terms and conditions should be preliminary agreed and stated in writing between the parties.

3.2 Unless otherwise expressly agreed with Fastwel, all the deliveries of Fastwel equipment will be carried out only after the official purchase order is obtained and provided that the ordered products have been prepaid in full. Other terms and conditions of cooperation should be made in writing.

3.3 Any delivery of Fastwel electronics is submitted with the right package in accordance with the current rules and standards in the Member States of the European Economic Area. The purchaser independently bears all risks regarding the compliance of package and marking of Fastwel products with legislation requirements being in effect at the place of purchased products destination (in the buyer's country). The specified condition excludes unequivocally any liability of Fastwel for possible non-compliance of package and marking of products with the requirements of legislation of the country of products destination.

3.4 In general, all components of the supply are properly protected with respect to freight, in order to avoid any damage to the supply, third parties, environmental damages or unrelated goods, as consequence of wrong packaging.

3.5 Each package unit is labeled on the exterior area with the indications of product's Part Number and Serial Number.

3.6 The support documents for the order should be made either in English or in Russian unless otherwise agreed between parties in writing.

3.7 Fastwel does not pay penalties and does not cover costs associated with delay in the delivery of the products caused by actions of the third parties, force-majeure etc. - Fastwel doesn't bear any responsibility for non-execution or inadequate execution of the obligations in a case when it is caused by actions of the third parties (for example producers or suppliers of accessories), force majeure etc.

3.8 Fastwel declares that independently and at any time without damage, it has an exclusive right to define and change functionality architecture, bill of materials of its products without any preliminary coordination and approvals of the third parties.

4 OTHER CONDITIONS

4.1 Fastwel has the obligation to respect the current Russian legislation (including, but not limited to environmental, labor, social laws) in each moment and to apply it to its embedded electronics considering all and each execution phase, that is to say, from the design until the commissioning and subsequent maintenance. In this regard Fastwel is not liable to the user or other persons in connection with possible changes of the company's rules (including, but not limited to warranty, ordering policy) caused by changes of the Russian legislation.

4.2 Unless otherwise expressly agreed in writing, Fastwel provides no training for assembly\installation\adjustment\operation of its equipment.