spica

BOX20
Access Control Terminal

Technical Reference Manual

HARDWARE WARRANTY STATEMENT

SPICA INTERNATIONAL WARRANTS TO REPAIR OR REPLACE ANY MANUFACTURING DEFECTS, FAULTS OR PRODUCT DEFECTS ARISING FROM MATERIAL DEFECT OR WORKMANSHIP WITHIN PERIOD SPECIFIED BY STATUTE, AT ITS OWN COST AND IN THE HEADQUARTERS OF OUR AUTHORISED REPAIR SERVICE. IF THE SERVICE REPAIR PERIOD EXCEEDS 10 DAYS, THE WARRANTY PERIOD WILL BE EXTENDED FOR THE TIME OF REPAIR.

THE WARRANTY DOES NOT INCLUDE:

- FAULTS CAUSED BY NON-COMPLIANT OR IMPROPER INSTALLATION;
- FAULTS CAUSED BY UNAUTHORIZED OR NEGLIGENT PRODUCT USAGE;
- FAULTS CAUSED BY USAGE THAT DOES NOT CONFORM TO THE INSTRUCTIONS OF USE;
- FAULTS CAUSED BY INSUFFICIENT PRODUCT MAINTENANCE;
- FAULTS CAUSED BY UNAUTHORIZED MODIFICATIONS;
- MECHANICAL FAULTS, CAUSED BY THE USER;
- FAULTS CAUSED BY POWER LOSSES OR FLUCTUATIONS AND LIGHTNING;
- FAULTS CAUSED BY EXTREMES OF TEMPERATURE OR HUMIDITY;
- FAULTS CAUSED BY RUNDOWN BATTERIES;
- FAULTS CAUSED BY ACCIDENTS, DISASTERS (FIRE, EARTHQUAKE, WAR…).

THIS WARRANTY DOES NOT APPLY TO COMPONENT PARTS, SUBJECT TO CONSTANT WEAR AND TEAR (PRINTHEADS, TAPES...). THE WARRANTY WILL BE VOID IN CASES OF UNAUTHORIZED ATTEMPTS TO DISASSEMBLE OR MODIFY THE PRODUCT.

PRODUCT'S LIFE EXPECTANCY IS 5 YEARS.

WARRANTY PERIOD: 12 MONTHS FOLLOWING THE DATE OF THE DELIVERY TO THE ORIGINAL PURCHASER, BUT NO MORE THAN 13 MONTHS FROM THE DATE OF DELIVERY TO THE AUTHORIZED DEALER.

THIS WARRANTY IS EFFECTIVE UPON A RECEIPT OF THE WARRANTY CARD AND INVOICE.

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1 Introduction

1.1 General

BOX20 is the access control terminal that controls various peripheral devices at a specific access point (cards readers, door locks, activators, sensors) in order to perform access control function. BOX20 is a building block of computerized access control system of various complexities, from few doors on single location up to hundreds of doors (practically unlimited) on various locations. BOX20 communicates with application database via communication interfaces and capabilities. On-line operation is preferred to achieve up-to-date database but it is not necessary; BOX20 can perform full operation also without on-line database access.

1.2 BOX20 types and coding

With regard to the communication interfaces and system architecture there are two connectivity types of BOX20 terminals.

Master terminal (BOX20-MS). Master terminal has direct connection to the host computer. It can manage a group of up to 31 slave terminals in proprietary RS485 network segment, called party line.

Slave terminal (BOX20-SV). Slave terminal has no direct connection to the host computer, but indirect via BOX20-MS master terminal as one of up to 31 slave terminals on the party line.

Besides connectivity types BOX20 terminals could differ also with respect to built-in options.

Ethernet interface (E). This option is available only for master terminal (BOX20-MS).

Backup battery (B). BOX20 can be equipped with internal backup battery for normal, uninterrupted operation in absence of mains supply (230V AC).

Full product name consists of the generic name (BOX20) followed by codes that denote connectivity type and options. Bellow, find a table with all available BOX20 variations.

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BOX20 Types	Description
BOX20-MS	Master terminal
BOX20-MS-E	Master terminal with Ethernet interface option
BOX20-MS-B	Master terminal with Battery backup option
BOX20-MS-EB	Master terminal with Ethernet interface and Battery backup options
BOX20-SV	Slave terminal
BOX20-SV-B	Slave terminal with Battery backup option

Through this manual a generic name BOX20 is used where explaining facts that apply for all BOX20 types. When explaining facts, which apply to specific terminal type(s) only, complete terminal type designation is used.

1.3 Technical specifications

Physical	240mm x 160mm x 90mm (without cable leads), 240mm x 185mm x 90mm (with cable leads), Weight 1550g (without battery), 2130g (with battery).
Power supply	230V AC, 50Hz, power consumption less than 5VA.
Environment	Operating temperature: 0°C to +50°C, Storage temperature: -20°C to +70°C, Humidity: 10% to 90% (non condensing).
Readers	2 readers with wiegand or Data/Clock interface 2 LED indicator/reader.
Memory	1Mbit FLASH EPROM (firmware); 1Mbit SRAM with battery backup (up to 4500 events, up to 4600 user profiles).
Communication interfaces BOX20-MS	**Host interface:** • RS232-A: 9600 - 57600 baud, up to 30m distance, or • RS422: 9600 - 57600 baud, up to 1200m distance, or • Ethernet (option): 10BaseT, 10Mbps. **Party line interface:** • RS485: SDLC, 62.5 or 15.6 Kbaud, max. 32 terminals per segment max. segment length about 1200 m. **Auxiliary interface:** • RS232-A: 9600 or 19200 baud, up to 30m distance, or • RS422: 9600 or 19200 baud, up to 1200m distance. **Service interface:** • RS232-B: 19200 baud, up to 30m distance.
Communication interfaces BOX20-SV	**Party line interface:** RS485 (party line), SDLC, 62.5 or 15.6 Kbaud, max. 32 terminals per segment max. Segment length about 1200 m. **Auxiliary interface:** • RS232-A: 9600 or 19200 baud, up to 30m distance, or • RS422: 9600 or 19200 baud, up to 1200m distance. **Service interface:** RS232-B: 600 - 38400 baud, up to 30m distance.
Outputs	4 Relay outputs, configurable for passive or active output; Max. 30V AC/DC, 3A **Note:** With active outputs and internal power supply used for output activators the total current consumption of external devices is limited to 1.5A.
Inputs	4 digital inputs, optically isolated, passive or active For passive input: Uin = 12-24V AC/DC.
Battery option	Rechargeable Sealed Lead Acid, 12V/1,2 Ah.
Standards	LVD: IEC60950-1: 2001, EN60950-1: 2001, First Edition EMC: EN55022: 1998+A1: 2000 (CLASS A), EN55024: 1998, EN61000-6-2:1999

1.4 Certificates

1.4.1 Declaration of Conformity

SPICA
INTERNATIONAL

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E-mail: info@spica.si

EC Declaration of Conformity

Manufacturer:	Špica International d.o.o. Pot k sejmišču 33 1231 Ljubljana Slovenia

Details of electrical equipment:

Model numbers:	**BOX20**
Description:	**Access control terminal**
Directives this equipment complies with:	**89/336/EEC – Electromagnetic compatibility (EMC)** **73/23/EEC – Low voltage equipment (LVD)**

Harmonised Standards applied in order to verify compliance with directives:

EMC	EN 55022:1998 + A1:2000 (CLASS A); EN 61000-3-2:2000; EN 61000-3-3:1995 + A1:2001; EN 55024:1998; EN 61000-6-2:1999
LVD	IEC 60950-1:2001 and/or EN 60950-1:2001, First Edition

Vibration and Homidity

Test Reports issued by:	SIQ, Tržaška cesta 2 SI-1000 Ljubljana	Report ref. No: T223-0297/03 of 2003-09-08 T251-0519/03 of 2003-07-31
Technical construction file:	CE223-0046/2003	
Year in which CE mark was affixed:	2003	

Authorised Signatory
SPICA International
sistemi za avtomatsko identifikacijo, d.o.o.
LJUBLJANA, Pot k sejmišču 33
5

Manufacturer:

Name: *Tone Stanovnik*

Position: *Director*

Date of issue:
2003-10-14

Place of issue:
Ljubljana

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1.4.2 Attestation of Conformity

SIQ

Slovenski institut za
kakovost in meroslovje
Slovenian Institute of
Quality and Metrology

EC Attestation of Conformity
No. CE223-0046/2003

Company/manufacturer:	**Špica International d.o.o.**
Address:	**Pot k sejmišču 33, 1231 Ljubljana, Slovenia**
Product/test object:	**Access control terminal**
Model/type reference:	**BOX20**
Testing laboratory:	**Slovenian Institute of Quality and Metrology (SIQ)** **Tržaška cesta 2, SI-1000 Ljubljana, Slovenia**

The product complies with the essential requirements of the following directives:

89/336/EEC – Electromagnetic compatibility (EMC)

73/23/EEC – Low voltage equipment (LVD)

This attestation applies to the particular sample of the product provided for testing and certification. The detailed test results and standards used as well as the operation mode are listed in:

EMC Test Report No.	**T251-0519/03 of 2003-07-31**
EMC Certificate No.	**C251-0399/03 of 2003-07-31**
Test standards:	**EN 55022:1998 + A1:2000 (CLASS A); EN 61000-3-2:2000;** **EN 61000-3-3:1995 +A1:2001; EN 55024:1998; EN 61000-6-2:1999**

LVD Test Report No.	**T223-0297/03 of 2003-09-08**
LVD Certificate No.	**C223-0161/03 of 2003-09-08**
Test standards:	**IEC 60950-1:2001 and/or EN 60950-1:2001, First Edition**

Vibration and Humidity treatments Test Report No. /
Vibration and Humidity treatments Test Report No. /
Test standards: /

This attestation is released with the above mentioned attestation number by the Slovenian Institute of Quality and Metrology.

After preparation of the necessary technical documentation as well as the EC Declaration of Conformity the CE marking as shown below can be affixed on the equipment.

CE

Date of issue
2003-10-14

Authorized signature

2 BOX20 Installation Manual

The content of installation manual is confined to information that is necessary for mounting and installation of BOX20 terminal.

Only trained people may carry out the installation of the device.

2.1 Safety precautions

Mains power:

Device is supplied by 230V. Caution when opening the housing, danger of electric shock.

All installation and repair service may only be made by authorized trained service personnel.

230V AC socket outlet shall be installed near the equipment and shall be easily accessible.

Fuses:

For replacement use and install fuses strictly according to manufacturer's instructions as specified in section 2.6.

Battery:

For replacement use and install new battery strictly according to manufacturer's instructions as specified in section 2.7.

Upon reaching the end of their useful life, batteries should be disposed using appropriate collection and/or recycling channels.

Mounting:

Mounting means intended for wall mounting shall be adequate. For mounting instructions see section 2.2.

Relays:

Output relays are designed for a maximum of 30V DC/AC and 2A. For device safety reasons 230V may not be switched with these relays.

ESD (Electro Static Discharge):

During installation of the device the ESD protective measures must be considered.

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2.2 Outline schematics
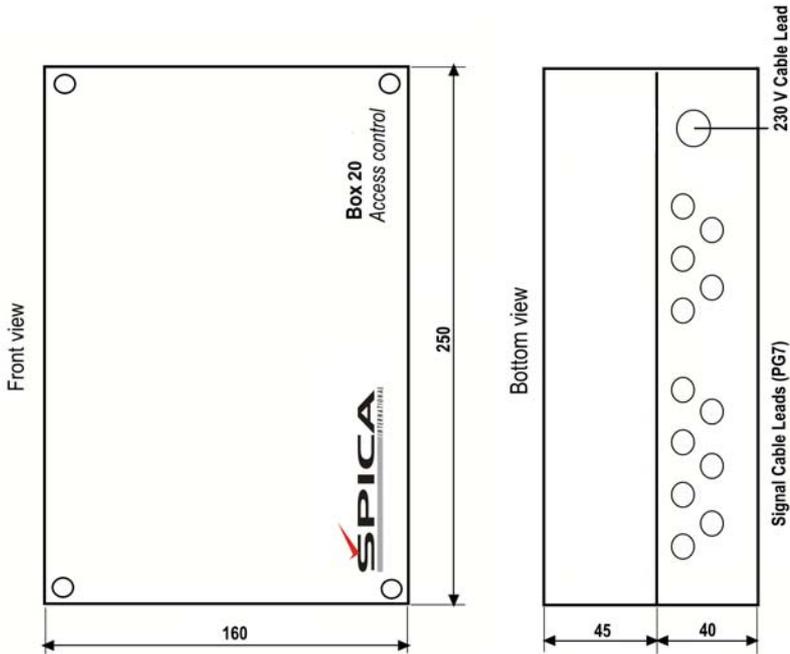
2.3 Mounting instructions

The terminal should be mounted on the wall or other appropriate base with four screws through the mounting holes located in BOX20 housing angles. Recommended screw diameter is 4mm. Use screw type and length according to base material (wood, brick, concrete, metal,). For some base material (concrete, brick, stone…) use appropriate screw anchor (e.g. plastic screw anchor 6mm x 30mm) to ensure solid mounting.

- Unscrew four screws in BOX20 housing and remove the housing cover.

- Locate positions of mounting holes on the wall (or other base). The holes should be positioned in a rectangle with dimension 228mm x 130,5mm.

- Prepare mounting holes accordingly (bore holes, insert plastic anchors…)

- Place the lower part of the housing on its place and fix it with the screws.

2.4 BOX20 main board

The following photo and picture show BOX20 main board.
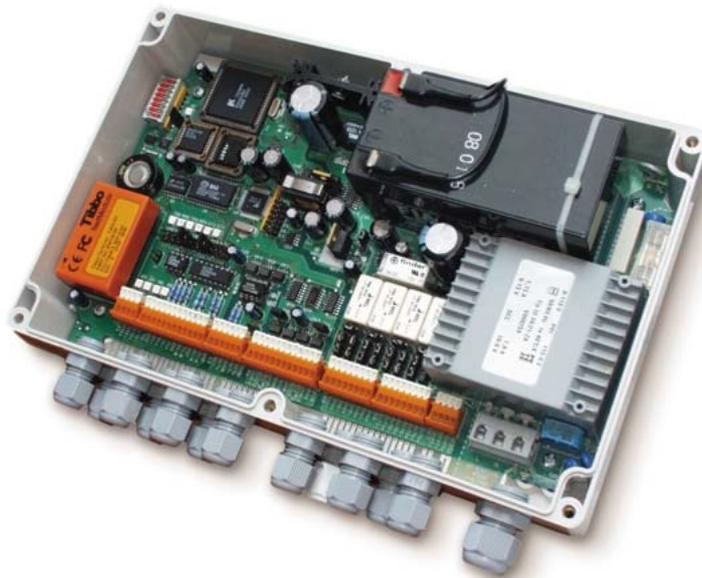
On the picture you can locate all the outlets, jumpers and LED indicators described in the following paragraphs. Position 1-2 of double position jumpers is marked with a dot.

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2.5 Outlets and Interfaces

2.5.1 Mains power supply (K8)

⚠️ **Caution, danger of electric shock!**

BOX20 terminal is powered from the mains supply, 230V, 50Hz. See the table below for connection instructions.

Block	Line
K8-1 (L)	Live
K8-2 (N)	Neutral
K8-3 (PE)	Protective Earth

Note. Always connect K8-3 outlet with protective earth cable.

2.5.2 Ethernet Interface (K1)

Ethernet interface (10Base-T) could be used as one of three options (beside RS232 and RS422 interface) for interfacing BOX20-MS-E terminal to the host computer. You should install the connecting Ethernet cable directly onto the termination block K11 according to the following table.

Block	UTP wire color (acc. to EIA/TIA 568B)	UTP wire color (acc.to EIA/TIA 568A)	Ethernet connector
K1-1 (ERX+)	Green-white	Orange-white	3
K1-2 (ERX-)	Green	Orange	6
K1-3 (ETX+)	Orange-white	Green-white	1
K1-4 (ETX-)	Orange	Green	2

RJ45 plug and connector orientation

Note. Ethernet interface is not default interface; it is an option (option 'E').

2.5.3 RS232 interface A (K2)

RS232 interface A could be used as a host channel or as an auxiliary channel connecting fingerprint verification readers to BOX20 terminal. The Selection is performed by appropriate jumper settings (see section 2.9.2).

2.5.3.1 RS232 interface A as a host channel

Beside Ethernet and RS422 interface, RS232 interface A could be used as one of the three possible interface options for the host channel, which means for interfacing BOX20-MS terminal to the host computer. Communication cable between BOX20-MS and host PC serial port should be made according to the following connection diagram.

Block	Line	Host DB9
K2-10 (RX-A)	RX	3
K2-11 (TX-A)	TXD	2
K2-12 (GND)	GND	5

Use shielded cable for RS232 communication. Connect shield together with signal GND (pin 5) on DB9 connector at host side.

2.5.3.2 RS232 interface A interfacing fingerprint readers

RS232 interface A could be used as an auxiliary channel interfacing up to two Bioscrypt VFLEX fingerprint readers according to the following connection diagram.

First VFLEX reader

VFLEX (DIN15, pigtail)	BOX20	Description
VCC (13, red)	K4-12 (VCC3)	+12V DC
POWER GND (11, black)	K4-11(GND3)	Power GND
SIGNAL GND (12, black-red)	K2-12 (GND)	Signal GND

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* TXD (9, violet)	* K2-10 (RX-A)	Communication VFLEX -> BOX20
RXD (10, violet-white)	K2-11 (TX-A)	Communication BOX20 -> VFLEX
EARTH GND (15, green-yellow)	K8-3 (PE)	Earth GND

Second VFLEX reader

VFLEX (DIN15, pigtail)	BOX20	Description
VCC (13, red)	K4-6 (VCC3)	+12V DC
POWER GND (11, black)	K4-5 (GND3)	Power GND
SIGNAL GND (12, black-red)	K2-12 (GND)	Signal GND
* TXD (9, violet)	* K2-10 (RX-A)	Communication VFLEX -> BOX20
RXD (10, violet-white)	K2-11 (TX-A)	Communication BOX20 -> VFLEX
EARTH GND (15, green-yellow)	K8-3 (PE)	Earth GND

* Transmit line (TXD) from each fingerprint reader to BOX20 RX-A outlet should be made through a small signal diode (e.g. 1N4148) according to the following drawing.
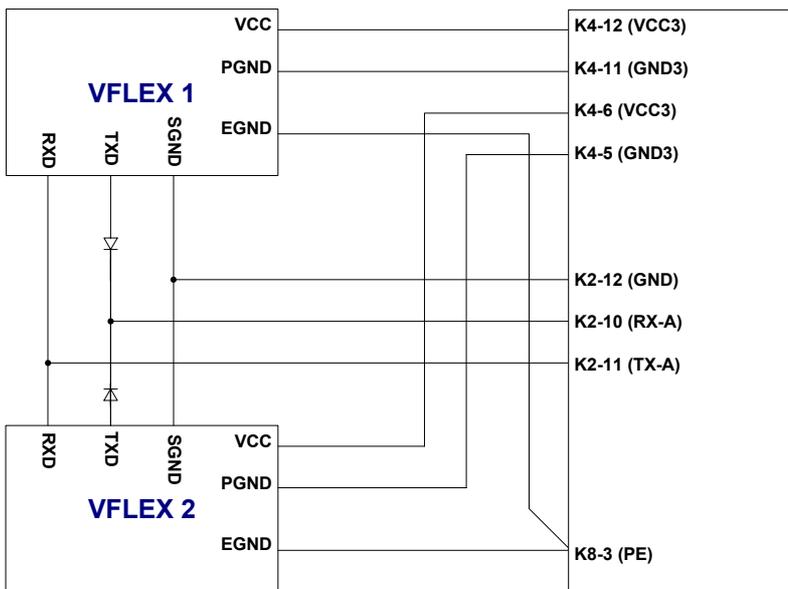
2.5.4 RS232 interface B (K2)

RS232 interface B is used as a service channel for local firmware upgrade procedure (for details see paragraph 2.12). Communication cable should be made according to the following connection diagram.

Block	Line	Host DB9
K2-7 (RX-B)	RX	3
K2-8(TX-B)	TXD	2
K2-9 (GND)	GND	5

Use shielded cable for RS232 communication.

2.5.5 RS422 host interface (K2)

RS422 host interface could be used as one of three options (beside Ethernet and RS232 interface) for interfacing BOX20 terminal to the host computer. Additional RS422/RS232 converter is required for host computer. Communication cable between BOX20 and this converter should be made according to the following connection diagram.

Block	Line	RS232/422 converter
K2-2 (RX-)	RX+	TX+
K2-3 (RX+)	RX-	TX-
K2-4 (TX-)	TX+	RX+
K2-5 (TX+)	TX-	RX-
K2-1 (GND)	GND	GND
K2-6 (GND	GND	GND

Take shielded cable with at least two twisted pairs for RS422 communication. Use one pair for RX+/RX-, other pair for TX+/TX- and shield for GND connection.

2.5.6 RS485 party line interface (K3)

RS485 communication interface is aimed for party line connection, which consists of one master (BOX20-MS) and multiple slave (BOX20-SV) terminals. In a party line the terminals are connected in series meaning that each terminal in the system, except the first and the last one, has one incoming cable (leading from the previous terminal in line) and one outgoing cable (leading to the next terminal in line).

Maximal number of slave terminals per each party-line network is 63. According to RS485 standard recommendations only 31 slave terminals can be directly connected to each party-line segment and total cable length should not exceed 1200m. If more terminals should be included, or distance is higher, RS485 repeater should be used to split party line to two segments.

We highly recommend more party lines with fewer terminals per party line instead of a long party-line(s) with many terminals or even repeaters. It depends on situation, but 10-20 terminals per party-line makes and appropriate balance.

Block	Line (cable)
K3-1(NET-)	NET+ (to the previous terminal)
K3-2 (NET+)	NET- (to the previous terminal)
K3-1 (GND2)	GND (to the previous terminal)
K3-4 (NET-)	NET+ (to the next terminal)
K3-5 (NET+)	NET- (to the next terminal)
K3-6 (GND2)	GND (to the next terminal)

Use shielded cable with at least one twisted pair for RS485 communication. Use the wires of the same twisted pair for NET+ and NET-. Use shield for GND connection.

2.5.7 Card reader Interface (K4)

2.5.7.1 Proximity card readers with wiegand interface

BOX20 terminal supports two proximity readers with wiegand interface. Supported data formats are: Indala 27 bit wiegand and standard 26-bit wiegand format. See tables below for connection diagram of various readers.

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2.5.7.1.1 PXR10, PXR20, PXRK10 readers (Indala/Motorola)

Reader 1, wire color	BOX20 block	Line
Red	K4 – 12 (VCC3)	+Vcc
Black + shield	K4 – 11 (GND3)	GND
Orange	K4 – 10 (LEDG-1)	LED green
Green	K4 – 9 (DATA0/CLK –1)	DATA0
White	K4 – 8 (DATA1/DATA-1)	DATA1
Brown	K4 – 7 (LEDR1-1)	LED red
Reader 2, wire color	BOX20 block	Line
Red	K4 – 6 (VCC3)	+ Vcc
Black + shield	K4 – 5 (GND3)	GND
Orange	K4 – 4 (LEDG-2)	LED green
Green	K4 – 3 (DATA0/CLK –2)	DATA0
White	K4 – 2 (DATA1/DATA-2)	DATA1
Brown	K4 – 1 (LEDR1-2)	LED red

Note! Jumper J19 should be set to position 1-2 for these reader types. See section 2.9.2 for more details on jumper settings.

2.5.7.1.2 PXR60 reader (Indala/Motorola)

Because of high current consumption of PXR60 (app. 1,2A), only one reader can be supplied by BOX20. If second reader is also used it has to be supplied by external power supply (EPS) of 12V – 24V DC, 1,5A.

Reader 1, wire color	BOX20 block		Line
Red	K4 – 12 (VCC3)		+Vcc
Black + shield	K4 – 11 (GND3)		GND
Orange	K4 – 10 (LEDG-1)		LED green
Green	K4 – 9 (DATA0/CLK –1)		DATA0
White	K4 – 8 (DATA1/DATA-1)		DATA1
Brown	K4 – 7 (LEDR1-1)		LED red
Reader 2 , wire color	BOX20 block	EPS	Line
Red		+Vcc	+Vcc
Black + shield	K4 – 5 (GND3)	GND	GND
Orange	K4 – 4 (LEDG-2)		LED green
Green	K4 – 3 (DATA0/CLK –2)		DATA0
White	K4 – 2 (DATA1/DATA-2)		DATA1
Brown	K4 – 1 (LEDR1-2)		LED red

Note! Jumper J19 should be set to position 1-2 for this reader type. See section 2.9.2 for more details on jumper settings.

2.5.7.2 Proximity card readers with Data/Clock interface

BOX20 supports two proximity readers with Data/Clock (magstripe emulation) interface with data format compatible to magnetic readers of track 2 (ISO, track 2, ABA). See tables below for connecting various readers.

2.5.7.3 HXR10, HXRS15 readers

Reader 1, block	BOX20 block	Line
2 (+12V)	K4-12 (VCC3)	+Vcc
1 (0V)	K4-11 (GND3)	GND
7 (LED V)	K4-10 (LEDG-1)	LED green
5 (CLOCK)	K4-9 (DATA0/CLK –1)	CLOCK
4 (DATA)	K4-8 (DATA1/DATA-1)	DATA
8 (LED R)	K4-7 (LEDR1-1)	LED red
Reader 2, block	BOX20 block	Line
2 (+12V)	K4-6 (VCC3)	+Vcc
1 (0V)	K4-5 (GND3)	GND
7 (LED V)	K4-4 (LEDG-2)	LED green
5 (CLOCK)	K4-3 (DATA0/CLK-2)	CLOCK
4 (DATA)	K4-2 (DATA1/DATA-2)	DATA
8 (LED R)	K4-1 (LEDR-2)	LED red

Note! Jumper J19 should be set to position 1-2 for this reader type. See section 2.9.2 for more details on jumper settings.

2.5.7.4 Magnetic card readers with Data/Clock interface

BOX20 terminal supports two magnetic stripe readers with standard Data/Clock interface and data format according to ISO standard for track 2 (ABA). See the table below for MSR40 magnetic reader connection.

2.5.7.5 MSR40 magnetic card reader

Reader 1, wire color	BOX20 block	Line
Red	K4-12 (VCC3)	+5V
Black	K4-11 (GND3)	GND
Green	K4-10 (LEDG-1)	LED green
Blue	K4-9 (DATA0/CLK –1)	CLOCK
Yellow	K4-8 (DATA1/DATA-1)	DATA
Brown	K4-7 (LEDR1-1)	LED red
Reader 2, wire color	BOX20 block	Line
Red	K4-6 (VCC3)	+5V
Black	K4-5 (GND3)	GND
Green	K4-4 (LEDG-2)	LED green
Blue	K4-3 (DATA0/CLK-2)	CLOCK
Yellow	K4-2 (DATA1/DATA-2)	DATA
Brown (via 150 Ohm)	K4-1 (LEDR-2)	LED red

Note! Jumper J19 should be set to position 2-3 for this reader type. See section 2.9.2 for more details on jumper settings.

2.5.7.6 Long range (telecomander) receiver with Data/Clock interface

BOX20 supports two long-range receivers with Data/Clock (magstripe emulation) interface with data format compatible to magnetic readers of track 2 (ISO, track 2, ABA). See tables below for connecting RXR2 receiver.

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2.5.7.7 RXR2 long range receiver

Receiver 1, block	BOX20 block	Line
12V-1	K4-12 (VCC3)	+Vcc
12V-2	K4-11 (GND3)	GND
GND	K4-11 (GND3)	GND
SCL	K4-9 (DATA0/CLK –1)	CLOCK
SDA	K4-8 (DATA1/DATA-1)	DATA
Reader 2, block	BOX20 block	Line
12V-1	K4-6 (VCC3)	+Vcc
12V-2	K4-5 (GND3)	GND
GND	K4-5 (GND3)	GND
SCL)	K4-3 (DATA0/CLK-2)	CLOCK
SDA	K4-2 (DATA1/DATA-2)	DATA

Note! Jumper J19 should be set to position 1-2 for this reader type. See section 2.9.2 for more details on jumper settings.

2.5.8 Inputs (K5)

BOX20 supports four inputs to monitor the status of input sensors. Each input can be either active or passive (configurable by setting jumpers to appropriate positions). An active input supplies electrical power to the connected sensor (e.g. door open/close detection switch, egress switch), while the passive input detects the logical voltage level of the input device (e.g. IR sensor). The standard voltage level of the sensors is expected to be from 10 to 20 V (DC or AC), with the power consumption ranging from 12 to 27mA.

Block	Line
K5-1 (IN1-)	INPUT1-
K5-2 (IN1+)	INPUT1+
K5-3 (IN2-)	INPUT2-
K5-4 (IN2+)	INPUT2+
K5-5 (IN3-)	INPUT3-
K5-6 (IN3+)	INPUT3+
K5-7 (IN4-)	INPUT4-
K5-8 (IN4+)	INPUT4+

Plus (+) and minus (-) suffixes show the polarity if the input in question is configured as active.

2.5.9 Outputs (K6)

BOX20 has four relay outputs for connecting activators. An output in BOX20 can be either active (voltage) or passive (dry contact). An active output supplies power (form internal or external power supply) to the connected activator, while the passive output provide "dry contact" output to the electrical circuit of the connected activator.

Combined with the external power supply the output relays enable broader range of output voltages (power) and galvanic separation of peripherals from the terminal's electronics.

Block	Line
K6-1 (OUT1-)	OUTPUT1-
K6-2 (OUT1+)	OUTPUT1+
K6-3 (OUT2-)	OUTPUT2-
K6-4 (OUT2+)	OUTPUT2+
K6-5 (OUT3-)	OUTPUT3-
K6-6 (OUT3+)	OUTPUT3+
K6-7 (OUT4-)	OUTPUT4-
K6-8 (OUT4+)	OUTPUT4+

Plus (+) and minus (-) suffixes in the Line column represent the polarity of the output block if the output is configured as active.

2.5.10 External power source input / power output (K7)

Termination block K7 could have two functions as follows.

a.)   **External power source input.** If activators (electrical locks…) connected to K5 have voltage or current demands that exceed BOX20 features, appropriate external power supply should be used and connected to K7 termination block.

  Note that in this case jumpers J35 and J36 must be OFF.

Block	Line
K7-1,2 (VEXT-)	Ext. Power supply - minus
K7-3,4 (VEXT+)	Ext. Power supply - plus

b.)   **Power output. BOX20 could power potential external device through termination block K7.** The voltage on K7 is not regulated, it's level is app. 12V DC and depends on current consumption. Overall maximum current source (devices on K7 and K6) is limited to 1,5A.

  Note that in this case jumpers J35 and J36 must be ON.

Block	Line
K7-1,2 (VEXT-)	Ext. device - minus
K7-3,4 (VEXT+)	Ext. device - plus

2.6 Fuses

There are two glass fuses on the BOX20 main board with following characteristics.

F1 – slow blow glass miniature fuse 5x20mm, 0.16A,T

F2 – slow blow glass miniature fuse 5x20mm, 2.5A,T

By defects use the replacement fuses with the same characteristics.

 Warning!

Fuse F1 is under high voltage 230V. Disconnect mains power before handling with this component.

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2.7 Battery

Some BOX20 terminals (with option B) have installed backup battery as uninterruptible power source. Expected battery lifetime is about 3 years, it depends very much on usage (number of charge/discharge cycles) and environmental temperature.

For replacement use the new battery of the same type (as specifies bellow). Cut two plastic leads and remove the old battery from BOX20 main board. Then place the replacement battery on its place and fasten it firmly using two appropriate plastic leads.

Upon reaching the end of their useful life, batteries should be disposed off using appropriate collection and/or recycling channels.

Battery specifications:
Manufacturer: Fiamm
Model: FG20121, 12V 1,2Ah
Description: Rechargeable sealed Lead-Acid Battery.

2.8 Interfacing BOX20 in Time&Space access control system

2.8.1 Communication

In access control system BOX20 terminals communicate with the host computer. Communication path depends on terminal type (MS or SV) and selected host interface as shown on the following picture.

Master terminal (BOX20-MS) communicates with host computer directly using one of three possible host interfaces: RS232, RS422 or Ethernet.

By RS232 interface BOX20-MS is connected directly to computer's serial port. RS232 interface cable may not be longer then 30m. For longer distances use RS422 interface.

RS422 interface could be used for distances up to 1200m. By RS422 interface BOX20-MS is connected to computer's serial port via RS422/RS232 adapter.

With Ethernet interface BOX20-MS-E terminal is directly connected to Ethernet LAN and communicates with host computer via LAN/WAN infrastructure using TCP/IP protocol.

Slave terminals (BOX20-SV) communicate directly with master terminal (BOX20-MS) over party-line interface (RS485). Actually, slave terminals communicate indirectly with host computer system, as master terminal serves only as a router between host computer and slave terminals. Each party line network consists of one master (BOX20-MS) terminal and up to 31 slave (BOX20-SV) terminals. Using party line repeater, up to 63 slave terminals may be connected to a party-line network.

See tables in paragraphs from 2.5.2 to 2.5.6 for details on connection of BOX20 communication interface.
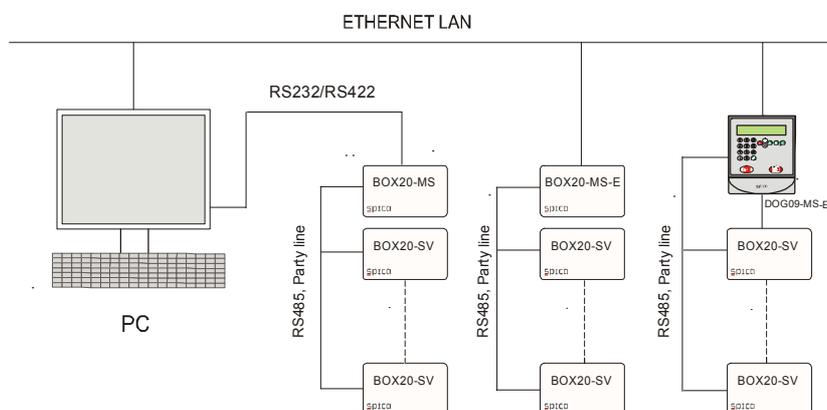
2.8.2 ID card reader

Two card readers (with wiegand or Data/Clock interface) can be connected to BOX20. These two readers can be installed on both sides of single access point (door) as ingress and egress reader, or on two access points as ingress readers. Cable length between reader and BOX20 should not exceed 50m. Do not install proximity readers too close to each other to prevent interference and unwanted readings. The minimum distance in any direction between two proximity readers is equal to reader's reading range multiplied by five. (E.g. minimum distance between two PXR10 readers with 12 cm reading range is 60 cm).

See detailed connection diagrams for various readers in chapter 2.5.7.

2.8.3 Fingerprint verification reader (Bioscrypt VFLEX)

Additionally to ID card readers up to two fingerprint verification readers can be optionally connected to BOX20. These readers are used for ID card owner authentication in application with higher security demands. As fingerprint verification readers are always a supplement to the ID badge reader they can be installed on both sides of single access point (door) as ingress and egress reader, or on two access points as ingress readers.

See detailed connection diagrams for fingerprint verification reader in paragraph 2.5.3.2.

2.8.4 Locking mechanism

BOX20 can be used with various locking mechanisms such as electromechanical lock, electromagnetic lock, motorized sliding door system, tripod, revolving door, and barrier… Locking mechanism of the first access point is always connected to OUTPUT1. If BOX20 supports two access points then locking mechanism of the second access point is connected to OUTPUT2. Depending on locking mechanism type configure these two outputs accordingly (for active or passive output) with jumpers J7 and J8 according to paragraph 2.9.2. The output should be configured as active for electromechanical or electromagnetic locks. For tripods, barriers, motorized sliding doors and revolving doors the output should be configured as passive. Depending on locking mechanism requirements you should configure output relay for normally open or normally closed function. This setting is done in the Event Collector Manager software module. See paragraph 3.3 and Time&Space User Manual for details.

2.8.5 Door status sensor

Door status sensor is a micro switch, which shows the status of the door (open/closed). Normally closed (N.C.) type of sensor has to be used (when the door is closed, the sensor contacts are closed; when the door is open, sensor contacts are open as well). Door status sensor of the first access point should be connected to INPUT1 and door status sensor of the second access point (if exists) should be connected to INPUT3. These inputs should be set as active by jumpers J9 and J11 according to paragraph 2.9.2.

By monitoring door status sensor BOX20 would send an alarm message to the host computer if door remains open too long or if door is broken-in. This function is enabled by enabling and configuring alarm1 and alarm3 (for INPUT1 and INPUT3 respectively) in the Time&Space Manager program. For details on alarm configuration and monitoring see paragraph 3.3 and Time&Space User Manual.

2.8.6 Door open button

Door open button is most likely used as egress key to open the door for exit. Note that "normally open" (N.O.) button has to be used for this function. The door open button of the first access point is connected to INPUT2 and door open button of second access point (if exists) is connected to INPUT4. These inputs should be set as active so jumpers J10 and J12 should be set accordingly (see paragraph 2.9.2).

When door open buttons are used and connected to INPUT2 or INPUT4, corresponding alarm function (alarm2 and alarm4) must not be enabled in the Time&Space Manager.

2.8.7 Additional alarm sensors

If door open sensors are not used, you could connect additional alarm sensors to the BOX20 inputs INPUT2 and INPUT4 (e.g. panic key, IR motion sensor…). Note that "normally open" sensors have to be used for this function (if sensors have voltage output it should be "normally off").

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By monitoring sensor status BOX20 would send an alarm message to the host computer when alarm condition appears. This function is enabled by enabling and configuring alarm2 and alarm4 (for INPUT2 and INPUT4 respectively) in the Time&Space Manager program. For details on alarm configuration and monitoring see paragraph 3.3 and Time&Space User Manual.

2.8.8 Alarm activator

You can connect alarm activator (alarm siren, alarm light…) to any spare BOX20 output. As BOX20 can be configured to activate any of its outputs when alarm condition appears, BOX20 will switch on this alarm activator.

Configuring alarm parameters within Time&Space Manager enables this function. For more details read paragraph 3.3 and Time&Space User Manual.

Set corresponding jumper to achieve active or passive function of specific output as required by activator (see paragraph 2.9.2).

2.8.9 Standard configurations

As a conclusion we can identify two main BOX20 configurations with respect to its peripherals: a single door configuration and a double door configuration as shown in the following pictures and corresponding tables. Note that use of door status sensors and Door open buttons is optional and could be omitted.

2.8.9.1 Single door configuration
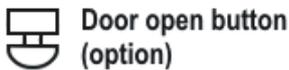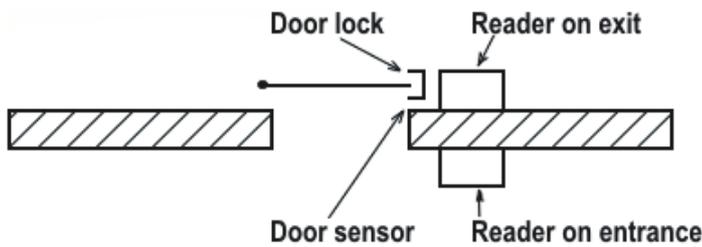
BOX20 outlet	Function
Reader -1 (K4-7 to K4-12)	Reader on entrance
Reader- 2 (K4-1 to K4-6)	Reader on exit
Output1 (K6-1, K6-2)	Locking mechanism (door lock…)
Output2 (K6-3, K6-4)	Alarm relay
Output3 (K6-5, K6-6)	Alarm relay
Output4 (K6-7, K6-8)	Reserved
Input1 (K5-1, K5-2)	Door status sensor (N.C.)
Input2 (K5-3, K5-4)	Door open button (N.O.), optional
Input3 (K5-5, K5-6)	Not used
Input4 (K5-7, K5-8)	Not used

2.8.9.2 Double door configuration
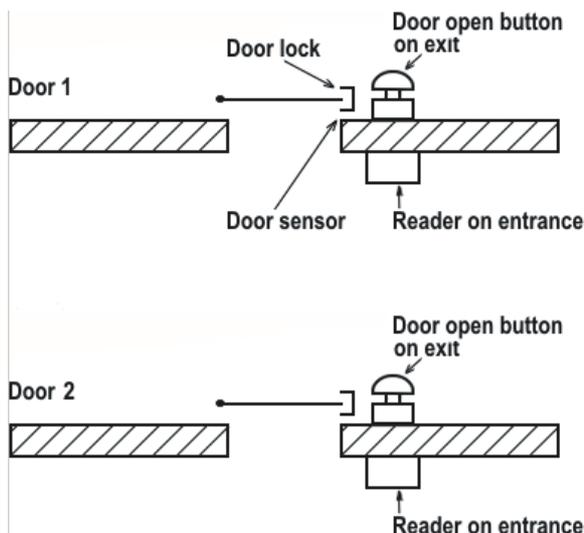
BOX20 outlet	Function
Reader-1 (K4-7 to K4-12)	Reader on first door, entrance
Reader-2 (K4-1 to K4-6)	Reader on second door, entrance
Output1 (K6-1, K6-2)	Locking mechanism (door lock…), first door
Output2 (K6-3, K6-4)	Locking mechanism (door lock…), second door
Output3 (K6-5, K6-6)	Alarm relay
Output4 (K6-7, K6-8)	Reserved
Input1 (K5-1, K5-2)	Door status sensor, first door (N.C.)
Input2 (K5-3, K5-4)	Door open button, first door (N.O.)
Input3 (K5-5, K5-6)	Door status sensor, second door (N.C.)
Input4 (K5-7, K5-8)	Door open button, second door (N.O.)

2.9 Configuration and settings

2.9.1 Deep Switch settings

There are 8 deep switches on BOX20 main board, position S1 with various functions as explained bellow.

2.9.1.1 Terminal address setting

Deep switches S1.1 to S1.6 are used to set terminal address according to the tables bellow. In these tables switch OFF position is marked with 0, while switch ON position is marked with 1. Available address range is address 'A' to address '⌂', that is 63 different addresses in total.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
S1.1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
S1.2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
S1.3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
S1.4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
S1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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	(	F	§	⌐	⌐	\	V	)	⌐	z	[	\	]	´	_	`
S1.1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
S1.2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
S1.3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
S1.4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
S1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	a	b	c	c	e	f	ç	h	i	j	k	l	n	r	c	p
S1.1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
S1.2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
S1.3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
S1.4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
S1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	q	r	s	t	u	v	w	x	y	z	{	|	}	~	⌂
S1.1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
S1.2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
S1.3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1
S1.4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
S1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S1.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Each terminal (master terminal and all slave terminals) in particular party line segment must have its unique address, max. number of terminals per each party-line network is 63. According to RS485 standard recommendations only 32 devices can be connected to each party-line segment. If more terminals should be included in particular party-line, RS485 repeater has to be used.

We highly recommend more party-lines with fewer terminals per party-line rather than a long party-line(s) with many terminals. It depends on situation but 10-20 terminals per party-line makes an appropriate balance.

2.9.1.2 Reader interface type setting

Two deep switches (S1.7, S1.8) are used to set appropriate reader interface according to the following table.

	Wiegand	Data/Clock
S1.7	ON	OFF
S1.8	OFF	ON

2.9.2 Jumper settings

J1 – Watch Dog Timer (WDT) Enable; with this jumper internal Watch Dog circuitry is enabled/disabled. In Normal operation J1 should be ON. It is used only for servicing purposes.

	WDT enabled	WDT disabled
J1	ON	OFF

J2, J3 – **Ethernet interface programming via RS232-A**. These jumpers are ON only when you want to configure or download internal ethernet module on BOX20 terminal via RS232-A interface.

	Normal operation	Eth. int. programming
J2	OFF	ON
J3	OFF	ON

J4, J5, J6, J7, J8, J9 – **Host channel interface selection**. With these jumpers host channel interface type is selected according to the following table.

	RS232-A	RS422	Ethernet
J4	OFF	OFF	ON
J5	OFF	ON	OFF
J6	ON	OFF	OFF
J7	OFF	OFF	ON
J8	OFF	ON	OFF
J9	ON	OFF	OFF

Caution! Note that host channel and auxiliary channel must not have the same interface type selected.

J10, J11 – **Auxiliary channel interface selection**. With these jumpers auxiliary channel interface type is selected according to the following table.

	RS232- A	RS422
J10	1-2	2-3
J11	1-2	2-3

Caution! Note that host channel and auxiliary channel must not have the same interface type selected.

J12, J13 – Host channel baud rate selection. With this jumper host channel baud rate is selected according to following table.

	9600	19200	38400	57600
J12	ON	OFF	ON	OFF
J13	ON	ON	OFF	OFF

J14 – Auxiliary channel baud rate selection. With this jumper auxiliary channel baud rate is selected according to the following table

	9600	19200
J14	ON	OFF

J15 – Party line baud rate selection. With this jumper party-line baud rate is selected according to the following table

Baud Rate	62.5 KBaud	15.6 KBaud
J15	OFF	ON

J16 – Reserved. Do not install this jumper.

J17 – Host channel encryption selection. With this jumper data encryption on host channel is selected.

	Encryption ON	Encryption OFF
J17	ON	OFF

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J18 – RS485 termination resistor ON/OFF. Jumper is used to connect/disconnect termination resistor (100 Ohm) on RS485 interface.

	Term. resistor ON	Term. resistor OFF
J18	ON	OFF

Note that within RS485 part line network termination resistor should be present on both ends of the party line. That means J18 should be ON on the first and the last BOX20 device.

J19 – Reader voltage selection; the jumper is used to set appropriate voltage for the readers (connected to K4) as follows:

	12V DC	5V DC
J19	1-2	2-3

Right setting for specific reader is specified in paragraph 2.5.7.

J20 – Loader start; jumper is used for manual start of BOX20 internal loader program. You will need it when upgrading firmware via serial channel (see paragraph 2.12 for more details). To start loader just put the jumper ON and remove it. For normal operation the jumper must be OFF.

	Start loader	Normal operation
J20	ON (for the moment)	OFF

J21, J22 – Reader interface selection. Jumpers should be set according to reader interface:

	Wiegand interface	Data/Clock interface
J21	ON	OFF
J22	ON	OFF

Wiegand interface is used by PXR proximity readers.

Data/clock interface is used by magnetic readers, HXR proximity readers and long range reader RXR2.

J23, J24, J25, J26 – NC/NO selection for outputs. The jumpers are used to select »normally open« (NO) or »normally closed« (NC) relay outputs OUT1, OUT2, OUT3, OUT4 according to following table.

	Position 1-2	Position 2-3
J23	OUT1 – NC	OUT1 – NO
J24	OUT2 – NC	OUT2 – NO
J25	OUT3 – NC	OUT3 – NO
J26	OUT4 – NC	OUT4 – NO

J27, J28, J29, J30 – Active/Passive selection for outputs. With these jumpers you can set outputs OUT1, OUT2, OUT3, OUT4 to be active (voltage source) or passive (dry contact) according to the following table.

	Position 1-2, 3-4	Position 2-3
J27	OUT1 – active	OUT1 – passive
J28	OUT2 – active	OUT2 – passive
J29	OUT3 – active	OUT3 – passive
J30	OUT4 – active	OUT4 – passive

J31, J32, J33, J34 – Active/Passive selection for inputs. With these jumpers you can set inputs IN1, IN2, IN3, IN4 to be active (this provides power to connected sensor like micro switch) or passive (sinking power from connected sensor) according to the following table.

	Position 1-2, 3-4	Position 2-3
J31	IN1 – active	IN1 – passive
J32	IN2 – active	IN2 – passive
J33	IN3 – active	IN3 – passive
J34	IN4 – active	IN4 – passive

J35, J36 – **External power mode on K7.** If these jumpers are ON, BOX20's internal power supply supplies input/output (I/O) elements like activators and sensors connected to K6/K5 and potential extra loads connected to K7. If these jumpers are OFF, external power source, connected to K7, is used to supply activators/sensors on K6/K5.

	Internal power supply for I/O and K7	External power supply for I/O
J35	ON	OFF
J36	ON	OFF

J37 – **Restart from battery;** jumper is used to start BOX20 operation from battery when mains power is off and the battery is disconnected. By putting J37 ON for a while, BOX20 is restarted. You should remove the jumper after terminal has started.

	Start loader	Normal operation
J37	ON (for the moment)	OFF

Note: By mains power fail, BOX20 switches to battery backup automatically. If you disconnect also the battery, restart is performed by J37.

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2.9.3 Ethernet interface – configuration and settings

BOX20-MS terminal with Ethernet module (BOX20-O-ETH) can be directly connected to a 10BaseT Ethernet LAN.

You can configure Ethernet interface using the **Tibbo Device Server Manager** program, which supports:

- Ethernet interface configuration and settings over the network with auto discovery feature; note that auto discovery works only within a single network segment (does not work over routers).

- Ethernet interface configuration and settings over the network from the address book; you can create entries in this address book when installing terminals with predefined IP addresses. You should use this type of programming when installing BOX20 terminals in remote network segments (behind the router). Here you have the choice to use either inband (programming using TCP connection) or out-of-band (programming using UDP datagrams) access method.

- Ethernet interface configuration and settings via serial port.

Ethernet interface configuration and settings over the network are performed while being in their normal operating mode (no local action is required).

For Ethernet interface configuration and settings over serial port you should enable PC to access its' serial port by setting jumpers J2 and J3 to ON and put Ethernet module to programming mode by bridging switch S2 for a while. The serial cable from the PC should be connected to interface RS232-A (K2, outlets TXA, RXA and GND).

2.9.3.1 Ethernet interface - IP address setting

Prior performing any other setting, you have to set IP address of BOX20 terminal. Simply click "Change IP" button and write IP in accordance with your network address.

2.9.3.2 Ethernet Interface - Parameter settings

BOX20 ethernet interface parameters should be set as explained bellow:
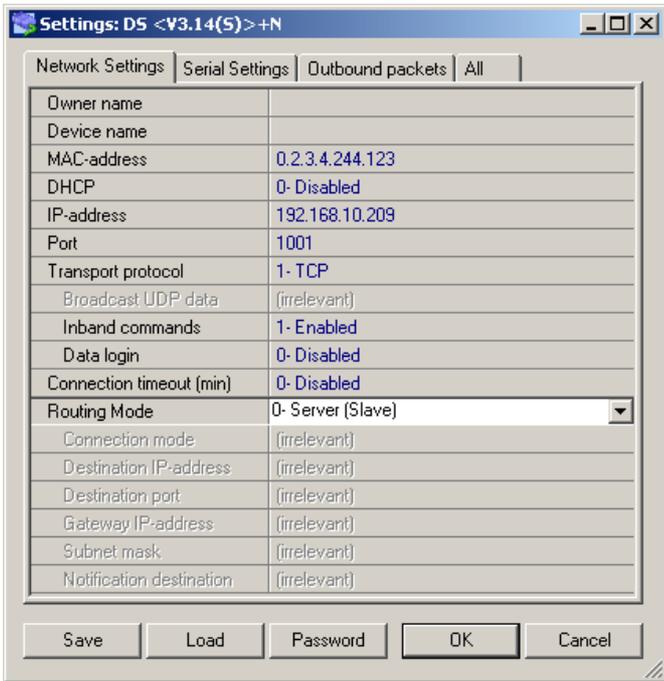
Network settings

DHCP:	0–Disabled
IP-address:	already set accordingly
Port:	default 1001, can be customized
Transport protocol:	1-TCP
Inband commands:	1-Enabled
Data login:	0-Disabled
Connection timeout:	0-Disabled
Routing mode:	0-Server
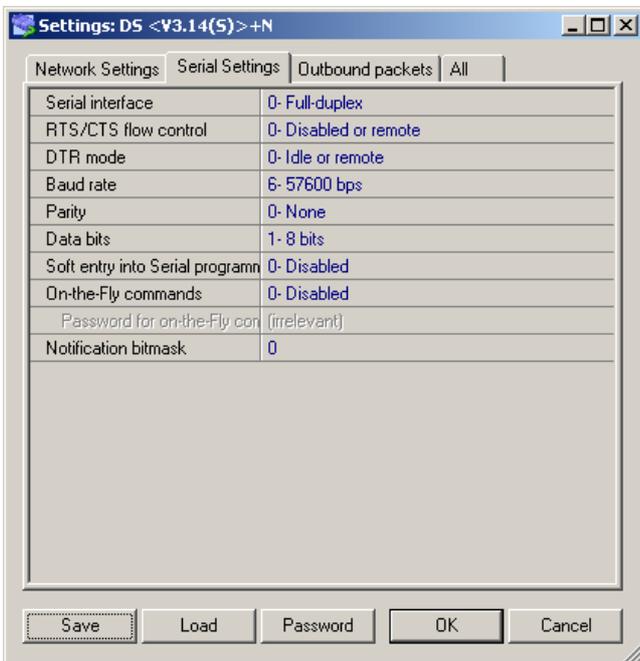
Serial settings

Serial interface:	0-Full-duplex
RTS/CTS flow control:	0-Disabled or remote
DTR mode	0-Idle or remote
Baud Rate:	must match BOX20 host channel baud rate (Default 57600)

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```
Parity:                         None
Data bits:                      1-8bits
Soft entry into ser. pr. mode   0-Disabled
On the Fly commands:            0-Disabled
Notification bitmask:           0
```
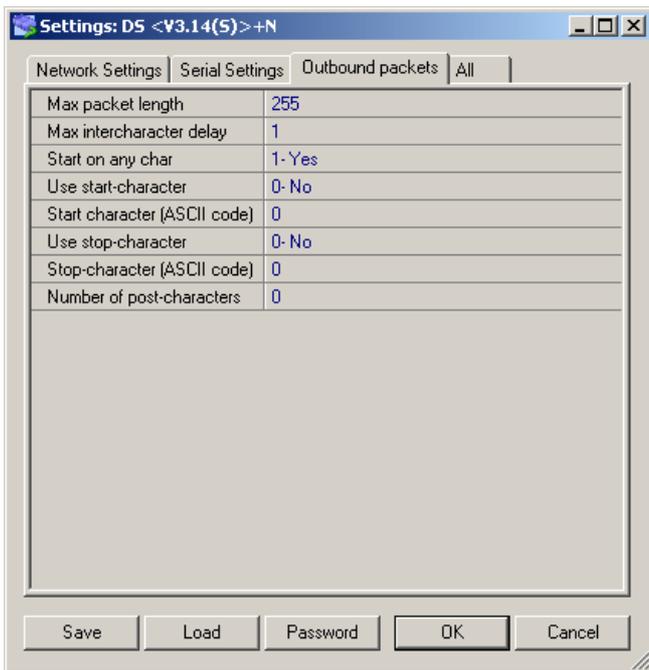

Outbound packets

```
Max. packet length:             255
Max. intercharacter delay:      1
Start on any char:              1-Yes
Use start-character:            0-No
Start-character (ASCII code):   0
Use stop-character:             0-No
Stop-character (ASCII code):    0
Number of post-characters:      0
```

2.9.4 Configuring VFLEX fingerprint reader parameters

Before we start using VFLEX reader we need to configure reader parameters. The configuration is carried out with a computer (MS Windows) using VeriAdmin program. VeriAdmin program resides on a CD which is enclosed to each VFLEX reader. For configuration purpose connect computer serial port to VFLEX reader, through VFLEX reader's AUX port (RJ11 connector on the bottom side of the reader) using a special serial cable (DB9 – RJ11).

The following are short instructions on how to configure the parameters:

1. **Run VeriAdmin program**.

2. **Choose RS232 port**. Go to *Network Setup* (icon in the toolbar or in the menu *Configure Network Setup*), select the serial port that is being used (COM1, COM2...), choose rate 57600 and select *Auto*.
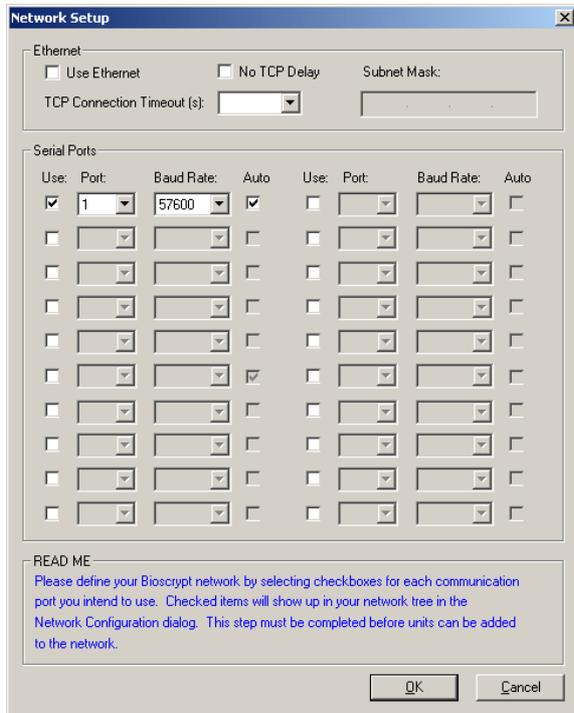
3. **Reader Login.** Go to Network Configuration Manager (icon in the toolbar or in the menu File/Network Configuration Manager). Choose the logged COM port on the tree and click the button *Add Unit*. VeriAdmin will find VFLEX reader and list it to the connections tree.
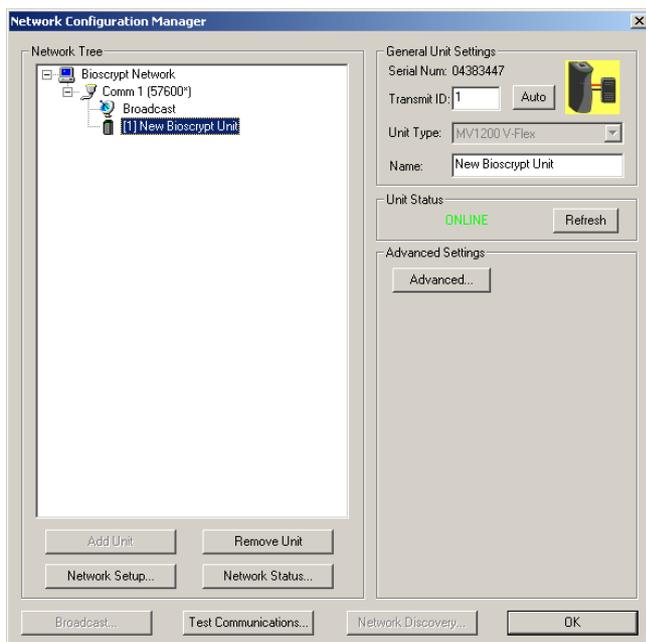
4. **Parameters Configuration.** Go to *Unit Parameters* (icon in the toolbar or in the menu *Configure/Unit Parameters*), tab *Communication*.

   - **Unit Network ID.** Use value 0 for address of the first pass VFLEX reader, and value 1 for the second pass VFLEX reader.

   - Other communicational parameters should be configured according to the schemes below.

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Parameters for the first VFLEX Reader:
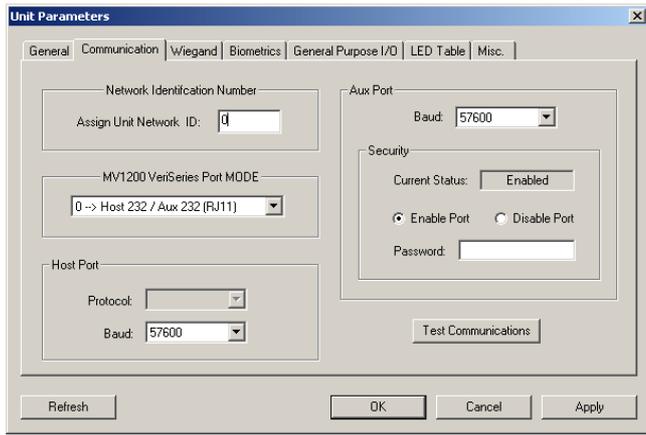
Parameters for the second VFLEX Reader:
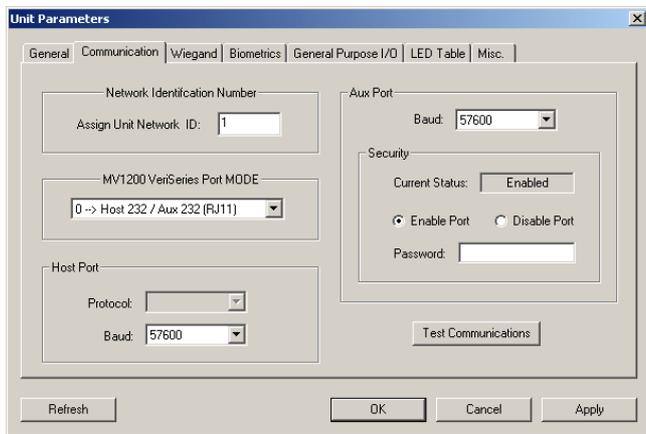
2.10 BOX20 LED indicators

There are eleven LED indicators on BOX20 main board to indicate status and some activities of the terminal. Here are explained their functions:

WD LED shows the party-line (RS485) status. In case of BOX20-SV terminal the indicator shows the party-line status whether the terminal is connected with the master terminal or not. In case of BOX20-MS master terminal the indicator shows status information (connected/disconnected) of slave terminals.

- BOX20-SV. If terminal is connected (e.g. communication with master terminal is established) the LED flashes slowly within the period of app. 1s (LED-on time and LED-off time app. 0,5s). If terminal is not connected with the master terminal (e.g. communication with master terminal is not established) the LED flashes fast within the period of app 0,4s (LED-on time and LED-off time app. 0,2s).

- BOX20-MS. The LED flashes (LED ON/LED OFF) to indicate status of all possible 64 party-line terminals, e.g. master terminal itself and all possible 63 slave terminals. A cycle starts with LED-off of app. 2s which indicates a cycle start. After that LED flashes appear sequentially, indicating terminal status starting from terminal with lowest address ('A', 41H) and proceeding to the terminal with highest address ('△', 7FH). The whole procedure is repeated periodically. Terminal status of particular terminal is indicated by corresponding LED pulse duration as follows:

    - 0,2 s LED pulse - corresponding BOX20-SV terminal does not communicate with BOX20-MS (it does not exists, it is not connected, it is defective....),

    - 0,8 s LED pulse – corresponding BOX20-SV terminal communicates with BOX20-MS, and

    - 2s LED pulse – corresponding address belongs to BOX-20 terminal itself.

    The pause (LED-off time) between two consecutive LED pulses is app. 0.2s.

TXD LED indicates outgoing traffic on party-line (RS485). It flashes when terminal is transmitting on party-line.

RXD LED indicates incoming traffic on party-line (RS485). It flashes when traffic is indicated on party-line.

TXA LED indicates outgoing traffic on host channel (RS232 or RS422 or Ethernet). It flashes when terminal is transmitting on host channel.

RXA LED indicates incoming traffic on host channel (RS232 or RS422 or Ethernet). It flashes when terminal is receiving on host channel.

ST1 LED indicates application program/loader program status. When application program is running the LED is OFF, when loader program is running it is ON.

ST2 LED indicates Flash EPROM writing (download) is currently on (LED ON). Otherwise LED is OFF.

ER Ethernet red LED; normally off, blinks to indicate collision error.

EG Ethernet green LED; normally on, blinks when any network packet is received.

SG Status green LED; it's function is explained in the table bellow. When in normal mode with established TCP connection, it is on, and only goes off momentarily when ethernet interface routes a message in either direction (BOX20 to LAN or LAN to BOX20).

SR Status red LED; it's function is explained in the table bellow. In normal mode it is off and blinks on buffer overflow (single blink) or in the case of internal setting error (constantly with 1-second period).

Startup, entering the normal mode	SR and SG LEDs blink three times
Normal mode, setting error, eth. interface halted	SR LED is blinking constantly
Normal mode, LAN or serial buffer overflow	SR LED is continuously ON
Normal mode, BOX20 eth. interface set as server, no connection	SG LED performs double flashes
Normal mode, BOX20 eth. interface set as server, connection established, no routing	SG LED is continuously ON
Normal mode, BOX20 eth. interface set as server, connection established, routing	SG LED is continuously ON, goes OFF for a while when performing routing
Serial programming mode	SG and SR LEDs are blinking (green, red, green, red...)

2.11 Cables

- Mains supply cable (230V): PPY 3 x 0.75 mm^2.

- Party line cable (RS485).
  Recommended types:
  CAT.5 S-UTP (FTP)
  JY(St)Y 4 x 2 x 0.6mm

- Ethernet cable.
  Recommended types:
  CAT.5 UTP
  CAT.5 S-UTP

- RS232 cable (connects BOX20-MS terminal with the host computer and/or BOX20 with VFLEX fingerprint reader).
  Recommended types:
  CAT.5 S-UTP
  LIYCY 2 x 2 x 0,14 mm^2 to 2 x 2 x 0.5 mm^2.
  JY(St)Y 4 x 2 x 0.6mm

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- RS422 cable.
  Recommended types:
  CAT.5 S-UTP (FTP)
  JY(St)Y 4 x 2 x 0.6mm

- Reader cable. If the reader's original cables are not long enough, use shielded cable with at least 6 wires.
  Recommended types:
  Category 5 S-UTP (FTP)
  LIYCY 6x0.14 mm2 to 6 x 0.5mm2.
  JY(St)Y 4 x 2 x 0.6mm

- Cables for other peripherals (electrical lock, input sensors, audio indicators…): the choice is not critical; the only limitation is that the wire area cross-section should not exceed 0.5 mm^2.

Note: In order to be able to guide cables smoothly through the cable leads on the terminal, cable diameter is limited to 4 to 8mm for the mains cable and 3 to 6 mm for all other cables.

2.12 BOX20 firmware download procedure

BOX20 keeps its application program (firmware) in internal Flash memory. BOX20 application program can be updated (downloaded) anytime on the field using existing communication infrastructure already established between each BOX20 terminal and host computer (host channel). For these purposes besides the application program there is also a loader program resident in BOX20 Flash memory.

This firmware update feature dramatically simplifies firmware update activities when compared to classic EPROM changes.

Beside firmware updates via host channel, service personnel also have the opportunity to update BOX20 application program locally via BOX20 service channel.

2.12.1 BDU - BOX20 download utility

BOX20 download procedure is performed by BDU program (BOX20 Download Utility). You can find BDU program on the CD delivered with BOX20 terminal. Start the program simply by running bdu.exe on your computer.

2.12.2 BDU settings

Before issuing commands the following settings have to be done.
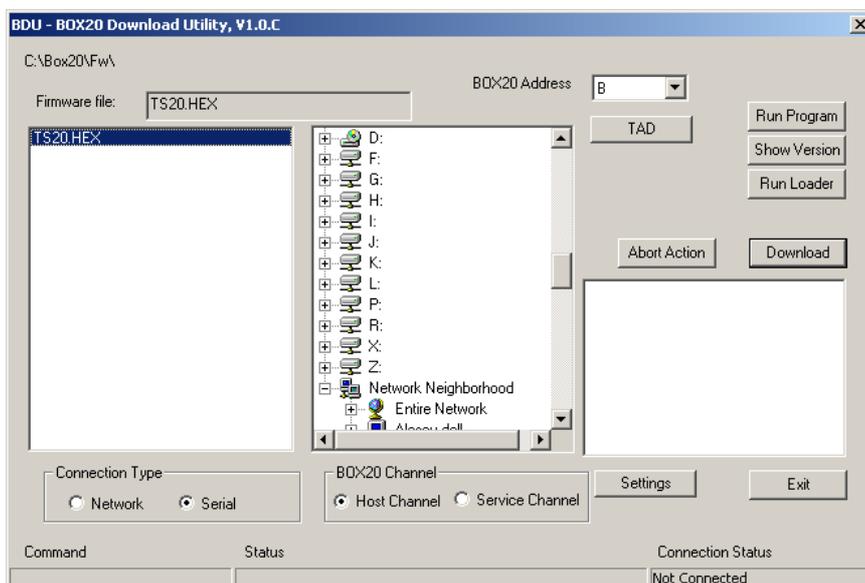
BOX20 address. Here you specify the address of target BOX20 terminal (select from drop-down menu) for single step commands (not for TAD function). The setting is available only if BOX20 Channel is set to *Host Channel*.

Firmware file. Browse the folder containing firmware file to be downloaded to target BOX20. Files with extension .HEX only are shown in left window. Select the right file with single click in left window.

Note. BDU and BOX20 loader support firmware files according to Motorola S-records format.

BOX20 channel. Here you can specify the channel currently used on target BOX20 for firmware download. Available selections: *Host Channel, Service Channel*

Select *Host Channel* if your PC is connected with target BOX20-MS using its host channel (RS232-A, RS422 or Ethernet interface), or if your PC is connected with target BOX20-SV (indirectly via BOX20-MS) using its party-line channel (RS485 interface)

Select *Service Channel* if your PC is directly connected to the target BOX20 via it's service channel (RS232-B interface).

Connection Type. Select the connection type between your PC and target BOX20 for firmware download. Available selections: *Serial, Network*

Select *Serial* if your PC communicates with target BOX20 via serial port (RS232 or RS422). Select Network if your PC communicates with target BOX20 via LAN (TCP/IP).

Note. With selection BOX20 Channel = Host Channel both connection types (Serial and Network) are available. But with selection BOX20 Channel = Service Channel only Serial connection type is available.

Connection Settings. Reach this settings by clicking button named »Settings«.

Set of available settings depends on selected *BOX20 Channel* and *Connection Type*, so it is explained separately for each combination.
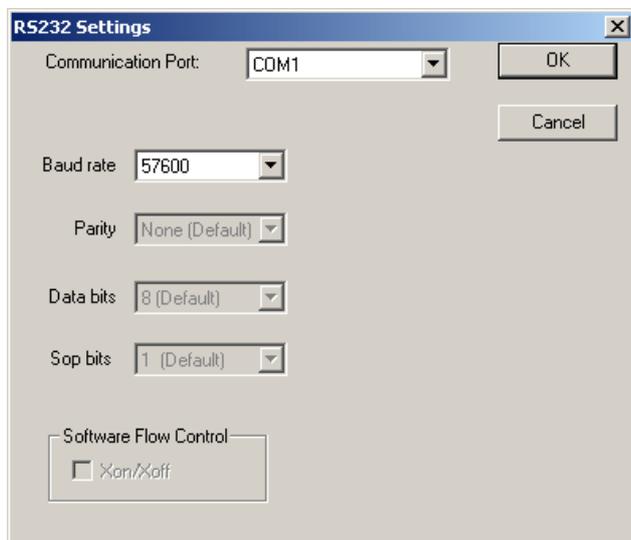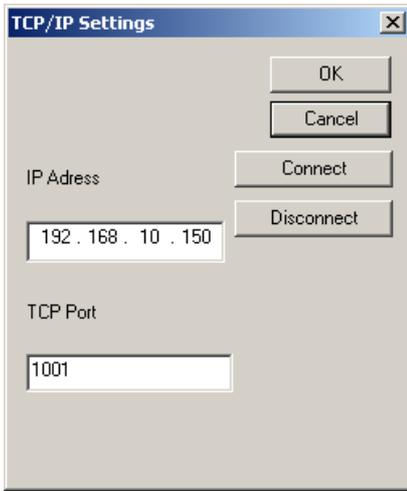

Host Channel, Serial Connection

With this combination the available connection settings are as follows.

Communication Port: specify COM port used (Available options: COM1, COM2, COM3, COM4).

Baud Rate: set it equal as corresponding BOX20-MS interface setting.

(Available options: 4800,9600,19200,38400,57600.)

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Host Channel, Network Connection

IP Address: Specify IP address of the target BOX20-MS-E terminal.

TCP Port: Specify TCP port number for network connection. It must be equal as set in BOX20 Ethernet interface.

Upon parameter settings you can issue TCP connection request by clicking on *Connect* button. You can close TCP connection using *Disconnect* button. TCP connection status is shown in Connection Status field of main BDU window.
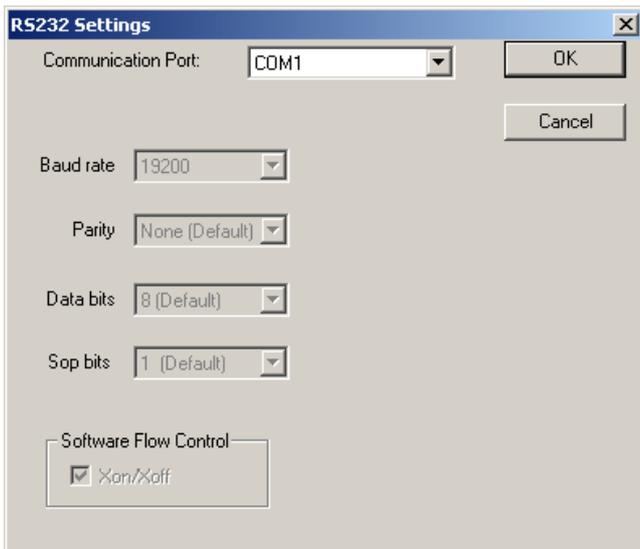
Service Channel, Serial Connection

Withthis combination the available connection settings are as follows.

Communication Port: specify COM port used (Available options: COM1, COM2, COM3, COM4).

Note. Baud rate is fixed to 19200 bps as it is fixed for BOX20 serial channel, too.

2.12.3 BDU commands

There are four single step command buttons available in BDU main window: Run Loader, Show Version, Run Program and Download. Next to these single step commands you can use complex TAD (Terminal Auto Discovery) command.

2.12.3.1 Single Step Commands

Upon completion of each single step command the BOX20 response is displayed in status field. If BDU does not get any response from target BOX20 within app.10s, »*BOX20 not responding*« message appears in the status field. A command execution could be aborted using *Abort Action* button.

Run Loader. Command is available only if Host Channel (BOX20 Channel selection) is selected. The command causes target BOX20 to exit application program and start its loader program. Successful command completion is signalled by »*Loader Started*« message in the Status field. Note that BOX20 running loader program, would exit loader and restart it's application program (if resident) automatically if idle (no commands received) for more than 75 seconds.

Show version. This command is used to obtain information on current firmware versions of BOX20 loader and application program. Information is displayed in BDU Status field in one of two formats explained by the following example:

BOX20 A: V7.1.d L:V1.0.c

BOX20 L: V1.0.c A:V7.1.d

In both cases BOX20 has loader program V1.0.c and Application program V7.1.d. In the first case (application program version written before Loader program version) target BOX20 is currently running application program, while in the second case (loader program version written before application program version) BOX20 is currently running loader program,

Run Program. Issuing this command causes target BOX20, which is currently running loader program, to restart application program. Application program is checked for integrity before running. Successful command completion is signalled by »*Program Running*« message in the status field. Otherwise »*Program not Running*« message appears which means there is no application program on target BOX20 or application program integrity errors have been found by integrity check.

Download. With this command firmware download procedure is started downloading selected HEX firmware file (Motorola S-records format) into BOX20 flash memory. Download progress is shown by a progress bar. Successful download completion is signalled by »*100%*« message in the status field. If BOX20 can not perform flash download procedure, »*Download Failed*« message is displayed (inconsistent or corrupted firmware file, BOX20 flash memory error…). Execution time of download command depends very much on firmware file capacity, communication speed, terminal type (BOX20-MS, BOX20-SV)... Typically it takes few minutes.
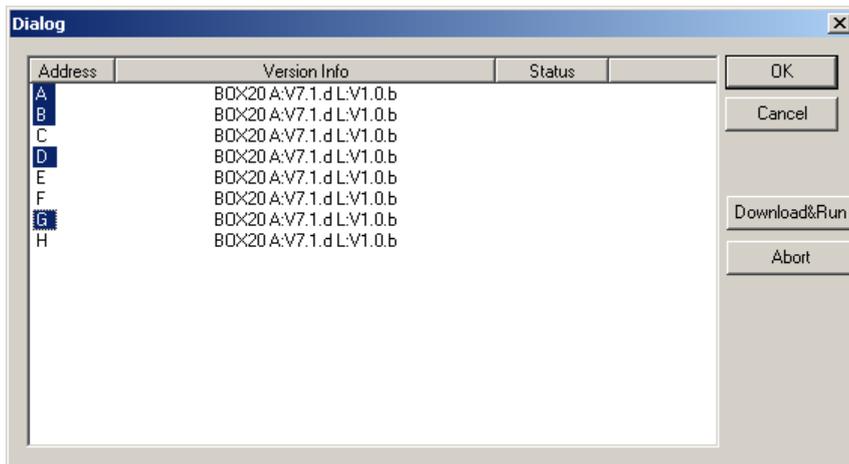
2.12.3.2 Terminal Auto Discovery Command (TAD)

TAD command is a very helpful tool especially in complex systems with many BOX20 terminals where it is sometimes difficult to know addresses of all terminals and where single step application program download would take quite long time and would need instant operator action for downloading terminals each by each.

TAD command is available only when *Host Channel* is selected using *Serial* or *Network* connection type.

The TAD function has multiple steps:

- It finds automatically all BOX20 terminals on selected connection, shows their addresses and version info.

- It makes you able to select the terminals you want to download with firmware file.

- It performs firmware download to selected list of terminals; after download completion for each terminal BDU issues »*Run Program*« command to start application program.

- It shows download completion status for selected terminals.

Let us describe the TAD command more detailed.

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TAD command is activated by a click on TAD button. Upon issuing TAD command the program starts with terminal auto discovery function. It polls all possible terminal addresses and displays information on existing terminals in TAD window, line by line. For each existing BOX20 terminal its address and version info is displayed. Version info format is displayed according one of two possible formats explained in previous paragraph 2.12.3.1 (*Show Version* command). If some lines appear with different version info format (without »BOX20« on the beginning) they obviously belong to other terminal types (not BOX20) in the system (DOG09 or BOX09). These terminals cannot be downloaded with application program firmware file. Auto discovery function takes app. 10 seconds for its completion.

When auto discovery is finished you can select terminals you want to download with application program. Do that simply by clicking their addresses in the first column of TAD window while CTRL key is depressed and their addresses become highlighted.
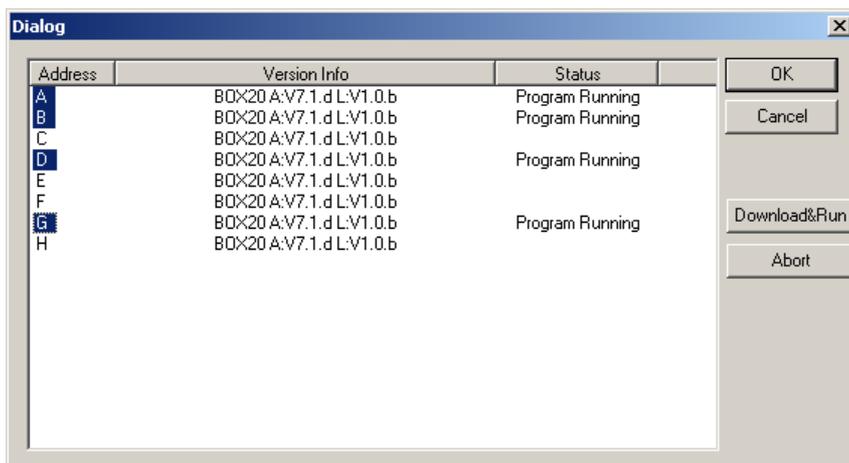
Once target terminals are selected, simply click »*Download&Run*« button in the TAD window. Now the program starts firmware download to selected list of terminals, each by each. After download completion for each terminal BDU automatically issues »*Run Program*« command to that terminal to start application program. If download/run procedure is finished properly for certain BOX20 terminal, BDU writes »Program Running« in Status column. If not, a message »*Failed*« would appear there.

Operator can abort download process any time by clicking »*Abort*« button in TAD window.

3 BOX20 User Manual

Chapter describes the operation of BOX20 as a component of an access control system. The term system as we use it here describes one or more terminals connected to the host computer(s) running Time&Space access control software.

3.1 Time&Space software modules

Time&Space software consists of three basic program modules.

- **Time&Space Manager** (hereinafter referred to as **TSM**). This is the main module which manages database of users, badges, access profiles, time zones, alarms, events, reports…

- **Event Collector Server** (hereinafter referred to as **ECS**). This module is typically installed as service. It performs all the communication between host computer and BOX20 terminals. It collects data about events recorded on the terminals (access events and alarm events). Apart from this, this computer downloads the data about users of the system (user profiles) and various other parameters to the terminals.

- **Event Collector Manager** (hereinafter referred to as **ECM**). This module issues commands to ECS to perform some interaction (data exchange) with BOX20 terminals.

For details on Time&Space software refer to Time&Space User Manual.

3.2 Functions of access control terminal

If we would try to describe the essential BOX20 functions, they would be the following:

- **Access request identification**

  BOX20 accepts user's access request and identifies it by reading the user's card on one of BOX20 readers.

- **Access arbitration**

  Upon access request identification BOX20 looks at user profile list, stored in BOX20 non-volatile memory, which contains data on users' access rights. Based on this information BOX20 decides whether the user is allowed to pass access control point (enter/exit the door) or not.

  User profile records are downloaded from host computer to the BOX20 either automatically when editing user access permissions in Time&Space Manager program or by invoking *Update Profiles* function in ECM. For more details look at Time&Space User Manual.

- **User authentication**

  In case of positive access arbitration phase cardholder identity may be optionally verified by fingerprint verification and/or PIN code verification.

  PIN code data is a part of user profile record explained above. Similarly to user profile records, fingerprint templates are downloaded from host computer to the BOX20 by invoking *Send Templates* function in ECM. For more details look at Time&Space User Manual.

- **Releasing door lock mechanism**

  Door lock mechanism may be any type of electro mechanic or electromagnetic door lock or door release, barrier, revolving door, sliding door, tripod barrier...

  Mechanism is released by corresponding BOX20 output (OUTPUT1, OUTPUT2) activation. BOX20 performs this action as a positive result of access control procedure (when access request is granted) or if selected access point mode requires releasing door lock mechanism.

- **Data exchange with the host computer (access events, alarm events, user profiles, fingerprint templates, parameters etc.).**

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Data exchange between the host computer and the terminal (i.e. any communication between the two) is performed by sending communication packets.

Access event or alarm event data is transmitted to the host immediately (on-line), without waiting for the host's request, if the host is able to receive it (Event collector is running and communication channel is enabled). Otherwise it is stored into local memory and sent to the host later (off-line). The terminal is in the on-line state when its internal memory is empty (no data stored); otherwise it is in the off-line state. When in on-line state the terminal sends to the host the transaction data (access event or alarm event data) as soon as the data are recorded. On receiving the host's confirmation of data reception, the terminal releases transaction from its internal memory and the transmission procedure is finished. If, however, the terminal does not receive the host confirmation for any reason, it retains the transaction in its internal memory and switches automatically to off-line state. When operating in off-line state, the terminal does not send data (access requests, alarm states) to the host on recording them, but stores transactions in the internal memory. The terminal tries to re-establish connection every 10 sec by sending the chronologically oldest data from the memory. On first receiving the host's confirmation, the terminal proceeds with the next data in line until the memory is empty and finally switches to on-line state. The terminal releases data from its internal memory only after receiving the host's confirmation of the receipt of a particular transaction.

User profile records are downloaded from host computer to the BOX20 either automatically when editing user access permissions in Time&Space Manager program or by invoking *Update Profiles* function in ECM. For more details look at Time&Space User Manual.

Fingerprint templates (up to two templates per user) are downloaded from host computer to the BOX20 by invoking *Send Templates* function in ECM. For more details look at Time&Space User Manual.

Parameters are downloaded from host computer to the BOX20 either automatically when modifying point properties in ECM program or by invoking *Reconfigure Points* function in ECM program. For more details look at Time&Space User Manual.

▪ **Alarm function**

BOX20 terminal can control alarm sensors and alert the host about the emergence of the alarm state. Usually, these sensors are door open sensors, emergency entry/exit buttons, IR detectors etc. Use parametrising to determine what alarm inputs the particular terminal monitors, what criteria are used to identify an alarm state for a specific alarm input, what action to perform at the emergence of an alarm state, and how to terminate the alarm state. The alarm state action may include, in addition to the message sent to the host, also the activation of siren, camera or similar peripherals connected to the terminal output.

3.3 BOX20 parametrising

Detailed BOX20 functions depends on the parameters which are mostly set as Point properties in the Event Collector Manager (ECM) program and some of them also in Time&Space Manager (TSM). Parameters are sent to the BOX20 through host communication channel. All these parameters represent the configuration of certain BOX20 terminal. They can be sent any time to the BOX20 using Reconfiguration command of Event Collector Manager program. Each BOX20 terminal is represented as two points in the Event Collector, one primary point (fist reader) and one secondary point (second reader). To edit parameters of specific terminal or point you should display view Configuration/Points (using command menu or left side tree), select specific point in right window and double click it (or command menu Point/Edit). Here you can edit several parameters, organized within tabs, which precisely define BOX20 functioning. Bellow we will describe these parameters, how they affect BOX20 functions and how we can edit them in the ECM or TSM program.

You can find more details about ECM and TSM program in Time&Space User Manual.

Terminal Type

ECM, view *Configuration-Points*, double-click selected point then display tab *Type.*
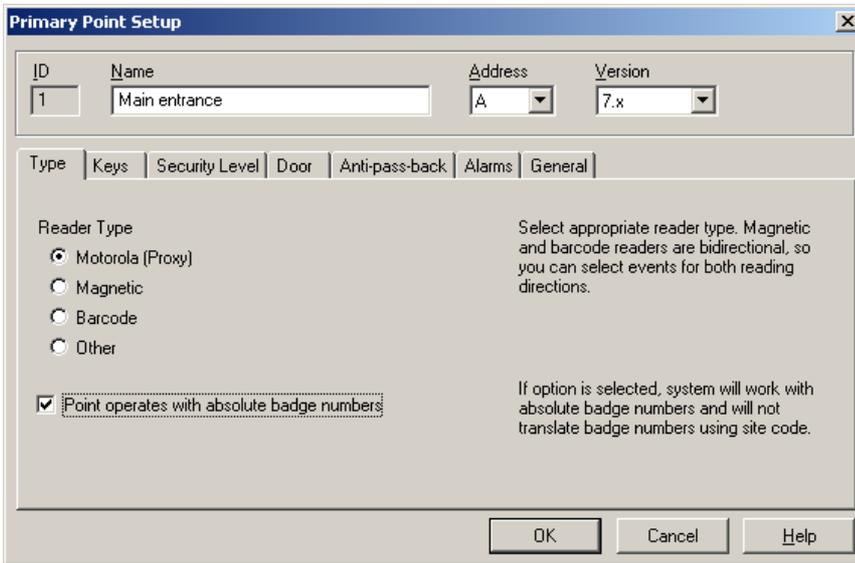
Here you can set the following parameters:

Name: assign a name to a terminal.

Address: define terminal's address (A, B,).

**Version:** set firmware major version (V5, V6, V7).

Reader Type: define reader type in use.

Badge Numbers: say if terminal uses absolute badge numbers.

Absolute badge number contains complete data record from the badge. It is a merge of site code and ID code from wiegand formatted card and magnetic card or complete data string from other type of cards. If BOX20 is not configured to absolute badge numbers, it will take only ID code from wiegand formatted card and magnetic cards (6 digits) or 6 lower digits from other cards.

Access control function

ECM, view *Configuration-Points*, double-click selected point, display tab *Keys.*
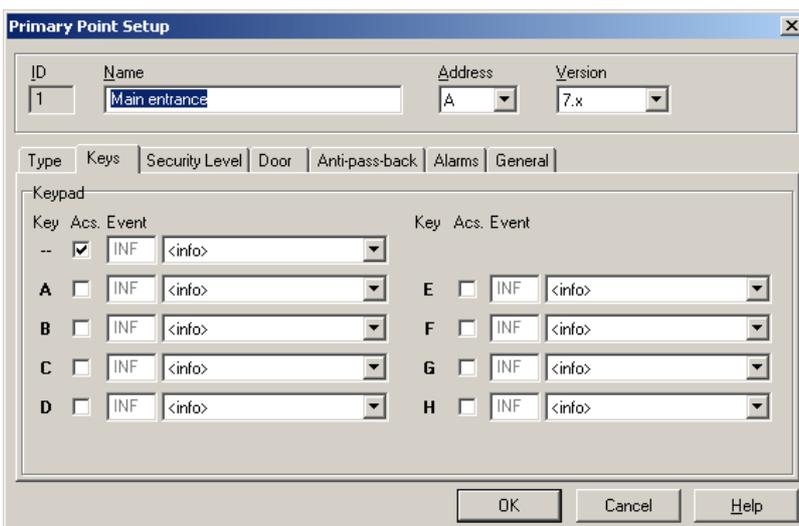
Here you can specify that BOX20 reader(s) supports access control function. This function means that with reading a card on BOX20 reader a cardholder issues an access request which means they would like to enter (or exit) the protected area. This function is a must for access control terminal. Without it, the terminal serves as Time&Attendance terminal within Time&Space system. You select access control function by enabling Prs. checkbox for the event(s) from the first row (one or two events) as shown on the screen shot.

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Security level

ECM, view *Configuration-Points,* double-click selected point, display tab *Security Level.*

Depending on the selected security level, the authorization of access requests may, beside of the ID code (card number) checking, consist also of PIN checking, schedule checking and fingerprint verification. Within access control arbitration procedure access requests are checked against the user profile list and fingerprint template list, both downloaded from the host computer. User profile list, stored in BOX20 non-volatile memory, contains data of all users with access permissions. A particular user's profile from this list is composed of the user's ID card's identification code, a PIN code and times (schedule references) when access is permitted. The PIN code and timetable data can be omitted if the selected security level does not require checking of these two items. Fingerprint template list, stored VFLEX non-volatile memory, contains up to two fingerprint templates for each user. If the access control procedure yields positive result, the terminal releases the door lock mechanism (electrical lock etc…). If the result is negative, access is denied and door lock mechanism is not released. Permission/denial is signalled with green/red light indicator on the terminal's reader.

Note: PIN code entry is possible only with combined readers with keypads like PXRK10.

Door settings

ECM, view *Configuration-Points,* double-click selected point, display tab *Door.*

In addition to access requests, the releasing of the door lock also depends on the following parameters:

Door Mode:

<u>Normal</u> - door is opened only with granted access booking.

Opened - door is constantly open.

Locked - door is continually closed.

According to schedule - door is continually open within the timetable limits, and opened on authorized request (granted access booking) outside the timetable limits.

The *Opened* and *Locked* modes are signalled by the blinking green and red light respectively.

Door Open Relay: We can set for how long the door open relay is active after authorized access booking.

Door Relay Type: Because of various types of door locks we can also set normally open or normally closed behaviour of that relay.

Anti Pass Back

ECM, view *Configuration-Points,* double-click selected point, display tab *Anti-pass-back.*
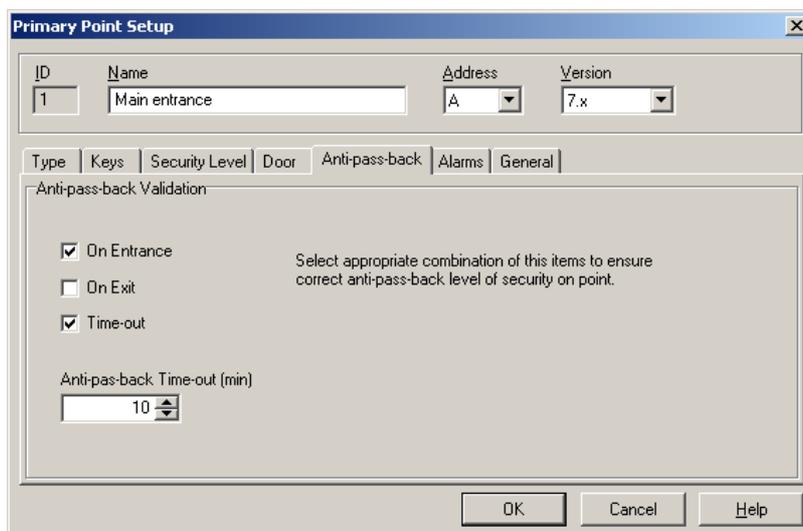
This feature is applicable only if BOX20 is used for bi-directional access control of a single access point (door), where the first reader is on the entrance and the second one on exit. With anti pass back feature you can disable the two consecutive entrances (*On Entrance*) and/or two consecutive exits (*On Exit*) with the same card. Beside that you could specify minimal time between the two consecutive access attempts of a certain cardholder (*Anti-pass-back Time-out*).

Anti Pass Back function as implemented in the BOX20 has a certain level of intrinsic forgiveness, which releases or resets anti-pass-back rules after 24 hours. For example: if somebody entered the door with a card booking and exited the room without proper exit booking they can enter again at earliest after 24 hours.

Alarm settings

ECM, view *Configuration-Points,* double-click selected point, display tab *Alarms.*

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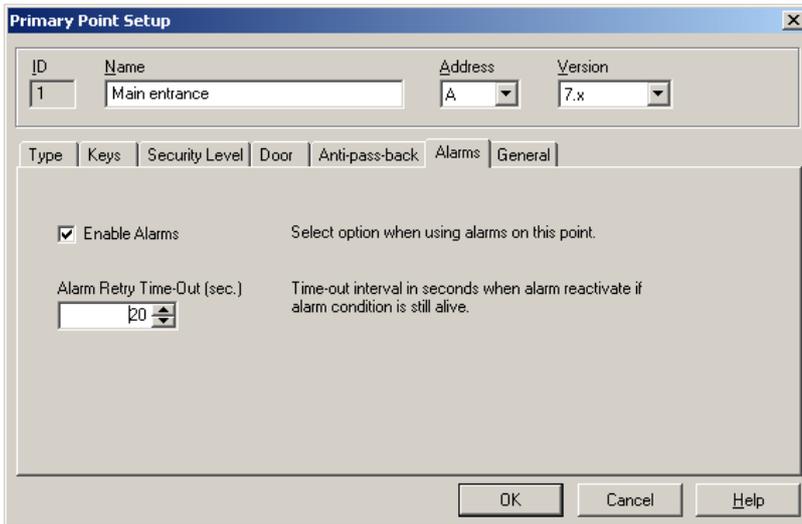
As we have mentioned in previous sections, BOX20 terminal can generate and send alarm messages. First of all, we should globally enable alarm function (*Enable Alarms*) for specific BOX20 terminal and specify the retry time for sending alarm messages to the host computer (*Alarm Retry Time-out*).

TSM, view *Space-Alarms-Configuration*, double-click selected alarm then display tabs: *General, Activators, and Advanced.*
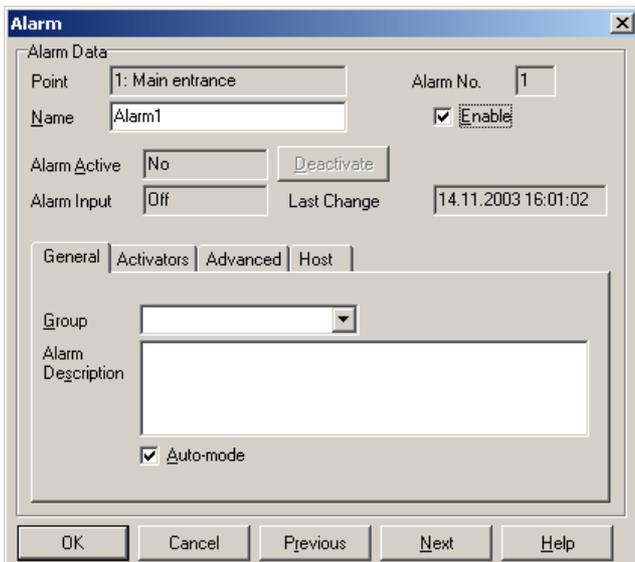
Beside these two parameters there are some additional parameters to configure each of four BOX20 alarm inputs. They are not set in ECM but rather in TSM program. These parameters are:

Enable – to enable/disable any of four alarm sources.

Alarm Auto-mode – if set, the alarm state is quitted if alarm condition disappears, otherwise only operator quits the alarm.

Activator No. X – you can specify that with alarm state appearance, specific BOX20 output should be activated; Activator No 1 to Activator No.4 correspond with BOX20 Output1 to Output4 respectively.

Delay – you can specify the time between appearance of alarm condition on specific BOX20 input and appearance of alarm state together with alarm message generation. Beside that you could also specify if this delay time is always valid or only in the case when alarm condition appears immediately after booking on specific BOX20 reader. For example; door sensor is connected to alarm input; alarm condition appears when door is open. With these parameters we can specify that alarm state should appear immediately if the door is not opened by the readers, otherwise the alarm state should appear if the door remains open for more then 10s. To achieve that enable checkbox at *first or second Reader* and set delay time to 10s.

3.4 BOX20 Usage

To enter the restricted area through the access point controlled by the BOX20 terminal, the ID card owner must perform one or more actions, depending on Security Level parameters selected for that specific point.

The first action always means submitting the ID card for reading (access request identification). With the magnetic stripe cards, the owner must swipe the card through the reader in either direction. With the RFID (proximity) cards, the owner must place it near the reader so that the ID card's face is parallel to the reader. Maximum reading range depends on the type of the reader and reaches from 10 cm (PXR10) to 70 cm (PXR60).

On receiving access request identification the terminal checks if the card has access permission (access arbitration), which means if this user is allowed to access on this door at this time.

On positive access arbitration, BOX20 optionally performs user's authentication which can include fingerprint verification and/or PIN code verification action. Fingerprint verification, of course, requires BOX20 configuration with VFLEX fingerprint reader. The user is prompted to present his/her finger on the fingerprint reader by its amber LED continuously on. The PIN verification requires BOX20 configuration with the keypad equipped readers. The user is prompted to enter the PIN code by amber LED flashing on ID card reader.

If the access arbitration and user authentication (if applied) phase yield positive result, the green light indicator on the ID card reader turns on and the door lock mechanism is released (electrical lock or similar). Otherwise the red light indicator on the ID card reader signals access denial.

This procedure described above applies when the *Door Mode* parameter of that access point is selected as "*Normal*" (door opened on request) or as "*According to Schedule*" but the booking time is not within selected schedule(s).

With *Door mode* parameter set to "*Opened*", or to "*According to Schedule*" and the booking time is within selected schedule(s) then door is continually open so free access is possible without any transaction. With *Door mode* parameter set to "*Blocked*" the door is closed and any access attempt would be denied. *Door mode* parameter is indicated by the adequate light indication on the reader (see the table below).

As we mentioned in the previous section door could be open with Door open button. Most often this button is used to open the door from the inside, or it is accessible to the authorized person only (receptionist or similar). On depressing this button, the lock is released in the same way as after reading any valid ID card.

In most cases the ID card readers connected to BOX20 terminals feature single bi-color LED indicator or two separate red and green LED indicators. Indicators have two functions: they signal the result of the access request check and indicate the selected *Door mode* parameter. See the table below for explanation.

Signalization	Description
Green LED on access request	Access granted
Red LED on access request	Access denied
Red and green (amber) LED on access request	Internal event buffer full
Green LED blinking	Door mode = Opened or According to Schedule
Red LED blinking	Door mode = Blocked
Amber LED (or green and red LED simultaneously) blinking	PIN code entry requested
Green and red LED alternate blinking	Alarm Activator-1 or Alarm Activator-2 is active

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