SIGMATEK

ETV 1591-H

Control Panel

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Control Panel ETV 1591-H

The control panel is an intelligent terminal for programming and visualization of automated processes.

A touch screen serves as the input medium for process data and parameters. The output is shown on a 15" XGA TFT color display.

To safely back up the data before the panel is shut down, an integrated UPS is used to buffer the +24 V power supply.

The available interfaces can be used to exchange process data or configure the build-in terminal. A SATA hard drive serves as the storage medium for the operating system, application and application data.

With the integrated VARAN manager, the ETV 1591-H offers the possibility to construct a high-performance VARAN system to operate for example, decentralized I/O modules, drive systems or communication modules.

Contents

Technical Data

1.1 Performance Data

Processor	1.4 GHz Intel® Celeron B827E
Intel® Smart Cache	1.5 Mbytes
BIOS	AMI
SDRAM 50-DIMM 20-pin	2-Gbyte DDR3
SRAM	512-Kbyte
Internal storage device	100-Gbyte SATA HDD
Interfaces	5x USB 2.0, type A (high speed 480 Mbit/s) 2x Gbit Ethernet (RJ45) 1x VARAN Out (RJ45) 4x optically decoupled inputs 4x optically decoupled outputs
Internal interface connections and devices	1x TFT LCD color display 1x touch 1x CF card socket 1x interface for connectable UPS
Display Resolution	15" TFT color display XGA, 1024 x 768 pixels
Control panel	5-wire touch screen (analog resistive)
Data buffer	yes
Signal generator	yes
Status LEDs	no
Real-time clock	yes (battery buffered)
Cooling	active (fan)

1.2 Electrical Requirements

Supply voltage	typically +24 V DC	
	minimum +20 V DC	maximum +30 V DC
Supply voltage (UL)	20-30 V DC (Class 2)	
Current consumption Power supply +24 V	1.25 A (without externally connected devices / 100 % CPU load) (WIN7 embedded) / 75 % brightness display)	
Inrush current	maximum 28 A for 170 µs	

The unit must be powered by a galvanically isolated source, which has a UL-certified secondary fuse with a maximum rated current of

a) 4 A at voltages from 0..20 Vrms (0..28.3 Vp) or
b) 100 VA/Vp at voltages from 20..30 Vrms (28,3..42.4 Vp).

1.3 Terminal

Dimensions with battery Dimensions without battery	358 x 313 x 109 mm (W x H x D) 358 x 313 x 81 mm (W x H x D)
Material	plastic housing: ASA
Weight	5.3 kg

1.4 Environmental Conditions

Storage temperature	-10 … +85 °C	
Operating temperature	0 … 50 °C	
Humidity	10-90 %, non-condensing	
EMC stability	EN 61000-6-2: EMC resistance EN 61000-6-4: noise emission	
Vibration tolerance	EN 60068-2-6	2-9 Hz: amplitude 3.5 mm 9-200 Hz: 1 g (10 m/s²)
Shock resistance	EN 60068-2-27	150 m/s²
Protection type	EN 60529 protected through the housing	front: IP54 rear panel: IP20

1.5 15" XGA Display

Type	15" TFT color display
Resolution	XGA, 1024 x 768 pixels
Color depth	18-bit (262 144 colors)
Pixel grid	0.297 mm x 0.297 mm
Active surface	304.128 mm x 228.096 mm
Backlighting	LED
Contrast	typically 700: 1
Brightness	typically 400 cd/m²
Angle CR > 10 from	left and right 80°, above and below 70°

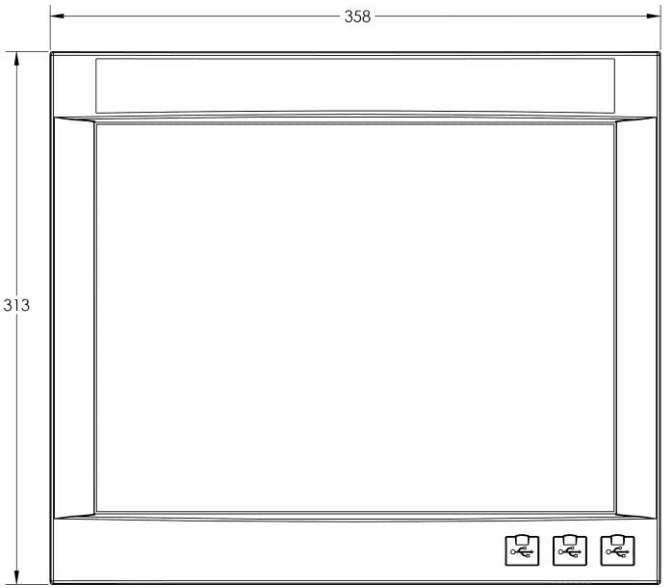
1.6 Control Unit

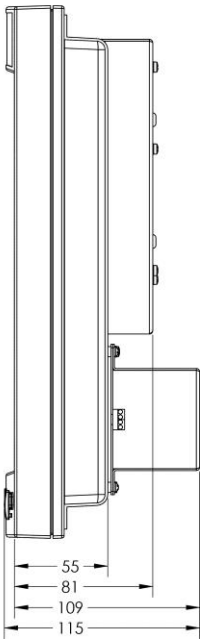
Touch panel	analog resistive film-glass touch panel
Resolution	12-bit Controller (USB)
Connection technology	5-wire

1.7 Miscellaneous

Article number	12-230-1591-H
Operating system	Windows Embedded Standard 7
Project back-up	100-Gbyte SATA HDD
Hardware version	2.x
Standard	UL 508 (E247993)

2 Mechanical Dimensions





3 Chemical Resistance

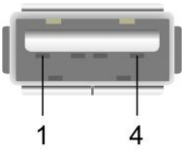
3.1 ASA Plastic Housing

Solution	Visual Effect
Acetic acid (5 %) at 23 °C	None
Chromium acid solution (40 %) AT 23 °C	None
Citron acid solution (10 %) AT 23 °C	None
Hydrochloric acid (36 %) at 23 °C	None
Lactic acid (10 %) at 23 °C	None
Nitric acid (40 %) at 23 °C	None
Sulfuric acid (38 %) at 23 °C	None
Sulfuric acid (5 %)	None
Ammonia hydroxide solution (10 %) at 23 °C	None
Caustic soda (1 %) at 23 °C	None
Caustic soda (35 %) at 23 °C	None
Ethanol at 23 °C	None
Isopropyl Alcohol at 23 °C	None
Methanol at 23 °C	None
Iso-Octane at 23 °C	None
n-Hexane at 23 °C	None
Toluol at 23 °C	yes
Acetone at 23 °C	yes
Diethyl ether at 23 °C	yes
SAE 10W40 motor oil at 23 °C	None
Sodium carbonate solution (20%) at 23 °C	None
Sodium chloride solution (10%) at 23 °C	None
Sodium hypochloride solution (10%) at 23 °C	None
Zinc chloride solution (50 %) at 23 °C	None
Ethyl acetate at 23 °C	yes
Water at 23 °C	None

4 Connector Layout

4.1 Front Connector

X10, X11, X12: USB 2.0 (type A, high speed 480 Mbit/s)

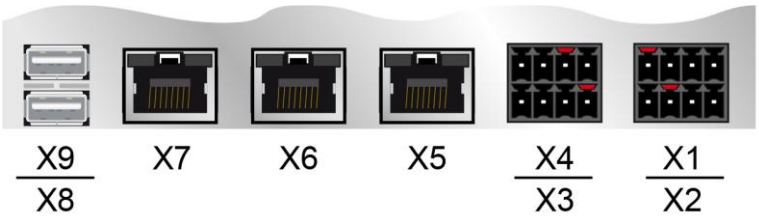


Pin	Function
1	+5 V_USB
2	D-
3	D+
4	GND

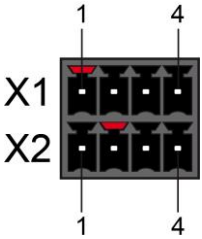
The 3 front USB interface connections are designed for a maximum total current of 500 mA!

It should be noted that many of the USB devices on the market do not comply with USB specifications; this can lead to device malfunctions. It is also possible that these devices will not be detected at the USB port or function correctly. Therefore, it is recommended that every USB stick be tested before actual use.

4.2 Rear Connectors

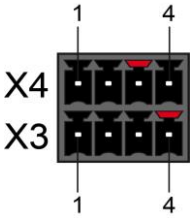


X1/X2: battery / supply



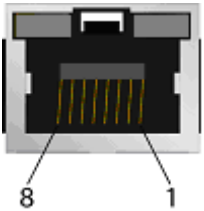
X1 - power plug	
Pin	**Function**
1	+24 V DC DIG IOs
2	+24 V DC
3	GND
4	GND
X2 - battery	
Pin	**Function**
1	NTC 1
2	Batt +
3	Batt -
4	NTC 2

X3/X4: digital in / outputs



X4 - Output	
Pin	**Function**
1	output 1
2	output 2
3	output 3
4	output 4
X3 - Input	
Pin	**Function**
1	input 1
2	input 2
3	input 3
4	input 4

X5/X6: Gbit Ethernet



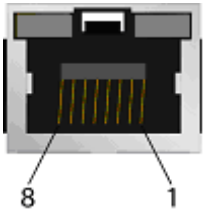
Pin	Function
1	RX +
2	RX -
3	TX +
4	n.c.
5	n.c.
6	TX -
7	n.c.
8	n.c.

n.c. = do not use

Problems can arise if a control is connected to an IP network, which contains modules that are not running with a SIGMATEK operating system. With such devices, Ethernet packets could be sent to the control with such a high frequency (i.e. broadcasts), that the high interrupt load could cause a real-time runtime error or runtime error. By configuring the packet filter (Firewall or Router) accordingly however, it is possible to connect a network with SIGMATEK hardware to a third party network without triggering the problems mentioned above.

For use in local networks only, not in telecommunication circuits!

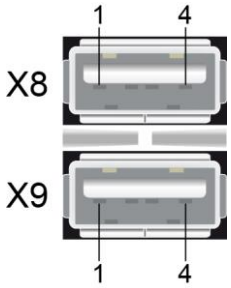
X7: VARAN Out



Pin	Function
1	TX+ / RX+
2	TX- / RX-
3	RX+ / TX+
4	n.c.
5	n.c.
6	RX- / TX-
7	n.c.
8	n.c.

More information on the VARAN bus can be found in the VARAN bus specifications!

X8/X9: USB 2.0 (type A, full speed 12 Mbit/s) - bi-level



X8	
Pin	**Function**
1	+5 V_USB
2	D0-
3	D0+
4	GND
X9	
Pin	**Function**
1	+5 V_USB
2	D0-
3	D0+
4	GND

The 2 rear USB interface connections are designed for a maximum total current of 500 mA!

It should be noted that many of the USB devices on the market do not comply with USB specifications; this can lead to device malfunctions. It is also possible that these devices will not be detected at the USB port or function correctly. Therefore, it is recommended that every USB stick be tested before actual use.

4.3 Applicable Connectors

USB: 4-pin, type A (downstream connector)
Ethernet: 8-pin RJ45
VARAN: 8-pin RJ45
Power supply: 4-pin Phoenix connector with spring terminals FMC1.5/4-ST-35
UPS: 4-pin Phoenix connector with spring terminals FMC1.5/4-ST-35
Digital IOs: 2 x 4-pin Phoenix connector with spring terminals FMC1.5/4-ST-35

The complete CKL 215 connector set is available from SIGMATEK under the article number 12-600-215.

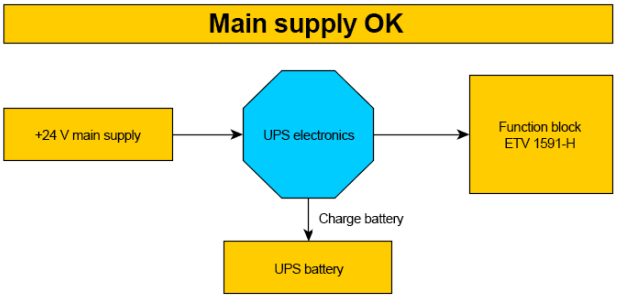
5 Uninterruptable Power Supply UPS

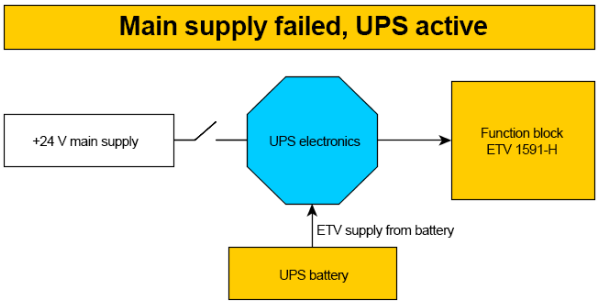
The complete ETV 1591-H panel consists of the actual ETV 1591-H function block and the preceding UPS current supply (battery and electronics),

5.1 Simplified Block Diagram

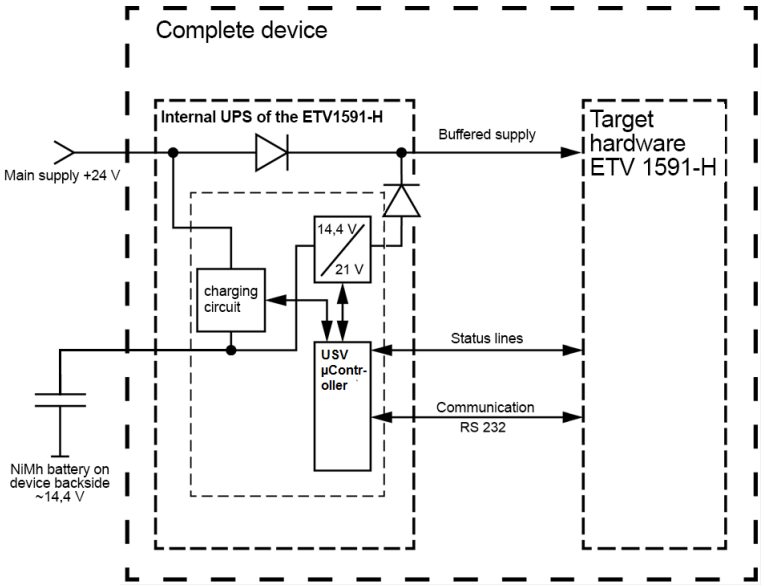
The battery is charged with the connected +24 V main supply. The UPS is active when a failure of the external +24 V main supply is detected. The UPS then provides the required voltage to the ETV 1591 functional block from the rechargeable battery to enable a safe shut down of the operating system.

Basic function of the UPS:





Circuit overview of the entire unit.



5.2 Technical Data

The technical data specifications for the UPS electronics and battery, such as voltage and temperature ranges are discussed in the following chapters.

5.2.1 Electrical Requirements for the Battery Pack

Battery type	maintenance-free nickel-metal hybrid (NiMh) battery pack	
Voltage	typically +14.2 V DC	
	minimum +12 V DC	maximum +18 V DC
Capacity	1100 mAh	
Charging current	typically 55 mA	
	minimum 40 mA	maximum 70 mA
Discharging current	typically 2.00 A	
	minimum 0.00 A	maximal 3,00 A

5.2.2 Buffering after a +24 V Main Supply Failure

Buffer time	maximum 60 seconds [1]
Battery deep discharge protection	typically +12.3 V DC [2]

1) The battery-buffered supply is always deactivated after 60 seconds of continuous buffering.
2) The battery-buffered supply is deactivated at the deep discharge threshold to protect the battery from completely discharging.

5.2.3 Environmental Conditions

Battery storage temperature	-20 ... +60 °C
Battery operating temperature	0 ... +50 °C [3]

3) Temperatures above and below this range are not allowed for the battery used, as it can be damaged.

5.2.4 Delivery Condition / Minimum Charge

The charge condition of the installed NiMh battery is not defined in the delivery condition. The UPS must be charged for at least 5 hours before initial use to ensure the proper function of the NiMh battery.

Procedure for rated operation:

- Apply power to the ETV 1591-H (24 V)
- Observe minimum charging time
- No other activity or command required for the UPS

5.3 UPS Operating Modes

Limit at which the operating mode of the UPS is changed.

5.3.1 Switching to Battery Operation

The UPS monitors the main supply voltage in order to switch to battery operation when the +24 V main supply fails. When a violation of the value limits is detected, the UPS switches the source of the buffered supply from the +24 V main supply to the battery and back.

Operating Mode	Threshold (hysteresis)	Meaning
Main supply OK	>19.4 V (±0.4 V)	The ETV 1591-H function block is powered by the +24 V supply. The battery can be charged.
Main supply failure	<18.4 V (±0.4 V)	The ETV 1591-H function block is powered by the UPS battery. Battery connected to a load.

5.3.2 Low Battery Charge Conditions

With the battery voltage measured under load, the low charge condition can be determined. Contrary thereto, the charging or open circuit voltage cannot be evaluated. The voltage under load is used for example, to immediately shut down Windows when a critical charge condition is reached.

Status	Batter Voltage (loaded)	Meaning
No critical status	>13.2 V	Battery normal.
Battery warning	≤13.2 V	The battery must be charged (recommended: >5 h) The capacity of the battery is sufficient to safely shut down the operating system (maximum 60 seconds).
Critical battery warning	≤12.8 V	The battery is has reached a very low charge, it is possible the less than 60 seconds of buffering cannot be provided. Windows is immediately shut down after a main power failure by the Windows service "SigmatekUpsMonitor"
Battery critical	≤12.3 V	Deep discharge protection threshold of the battery. The UPS deactivates the entire system so that the battery is not burdened further. The operating system is no longer shut down.

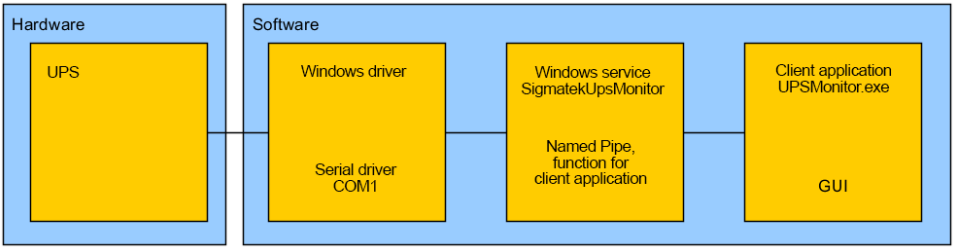
Critical states can occur:

- With a new, uncharged battery
- If the battery was not charged long enough
- If too many consecutive discharges were performed successively
- If the charging circuit is not functioning correctly
- If the battery is defective

5.4 UPS Interface

The Windows service "SigmatekUpsMonitor“functions as the UPS interface. SigmatekUpsMonitor manages the communication with the UPS via RS232, the UPS configuration, shutting down Windows and sending data to the application.

The SigmatekUpsMonitor Windows service must be used for the complete functional scope of the UPS.



5.5 Using the Interface for the UPS

The Windows service and UPS are configured via a Named-Pipe server. The application can configure the UPS and read data for the visualization with the following Pipe functions.

The connection to the Named-Pipe server is established through the name of the Pipe server and the individual GUID (Globally Unique Identifier).

The name of the Pipe server with the following GUID:
UpsStateServer{A7AF64DE-35C1-4f90-B8B0-8AC24A92F39C}

5.5.1 Named-Pipe Read Functions

Functions Overview Read Functions Send data SigmatekUpsMonitor Windows server to:		
Name	**Request-ID**	**Description**
EGetVersionNr	0x00	Version number of the Windows services
EGetUpsCommState	0x01	UPS connection status
EGetBatteryExchangeNeeded	0x02	"Battery exchange needed" status
EGetUpsStateInfo	0x03	Read UPS info
EGetShutdownTime	0x04	Read shutdown time setting (buffer time to shutdown)
EGetShutdownTimerActive	0x05	Info as to whether the shutdown timer is active
EGetTimeTillShutdown	0x06	Current shutdown timer value
EGetComPort	0x07	Name of the COM port used for the UPS
EGetAutoShutdownEnabled	0x08	Info as to whether the automatic shutdown is active
EGetCableType	0x09	Read the current cable type setting

EGetVersionNr		
Description	**Request-ID**	**Instruction Sequence**
Read the version number of the Windows service	0x00	• Open connection • Send 4-byte Request ID to the Pipe • Read 4-byte (struct SPipeServerVersion) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BYTE	Major version
2	BYTE	Minor version
3-4	WORD	revision

EGetUpsCommState		
Description	**Request-ID**	**Instruction Sequence**
Read connection status for the UPS	0x01	• Open connection • Send 4-byte Request-ID (0x01) to the Pipe • Read 1-byte (Boolean) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = no connection to the UPS TRUE = connected with UPS

EGetBatteryExchangeNeeded		
Description	**Request-ID**	**Instruction Sequence**
Retrieve information as to whether the battery is OK or must be exchanged. The battery is evaluated by the Windows service "SigmatekUpsMonitor". The status is true when the battery is no longer suited for the application. For further information, see the chapter Battery Exchange	0x02	• Open connection • Send 4-byte Request-ID (0x02) to Pipe • Read 1-byte (boolean) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = Battery is OK TRUE = The battery must be exchanged

EGetUpsStateInfo		
Description	**Request-ID**	**Instruction Sequence**
Read UPS information *Status bytes *Measurement values	0x03	• Open connection • Send 4-byte Request-ID (0x03) to Pipe • Read 19-byte (struct sUpsStateInfo) answer • Close connection

Answer			
ByteNo.	**Data type**	**Info**	
1	BOOL	Status: Valid flag FALSE = Data invalid TRUE = Data valid	
2	BYTE	Status byte "battery info", see next page for details	
3	BYTE	Status byte "UPS info", see next page for details	
4-5	WORD	not used	
6-7	WORD	not used	
8-9	WORD	not used	
10-11	WORD	Measurement value: Actual battery voltage	Conversion factor: 100 d = 1 V Value range +10.15 V → +25.09 V Accuracy: ±0.06 V Byte sequence: Little Endian Updating: every second
12-13	WORD	Measurement value: Battery voltage under test load (load = 3 A)	Conversion factor: 100 d = 1 V Value range +10.15 V → +25.09 V Accuracy: ±0.06 V Byte sequence: Little Endian Updating: while the battery is charging: every 60 seconds
14..15	WORD	Measurement value: Actual load current in the battery	Conversion factor: 1 d = 10 mA Value range 0 mA → 140 mA Accuracy: ±10 mA Byte sequence: Little Endian Updating: every second
16-17	WORD	Measurement value: Actual discharge current from the battery	Conversion factor: 100 d = 1 A Value range 0 A → 13.68 A Accuracy: ±0.06 A Byte sequence: Little Endian Updating: every second
18-19	WORD	not used	

Status Byte "Battery Info"	
Bit No.	**Description**
D0	Status: 1 = Battery is fully charged
D1	Status: 1 = battery is charged with constant current
D2	-
D3	Status warning: 1 = Battery capacity is low (battery voltage with load ≤13.2 V)
D4	-
D5	Error: 1 = Battery charging current too high (hardware error, ≥ 80 mA)
D6	Error: 1= Battery discharge current is too high (hardware error > 3.5 A)
D7	Error: 1 = The battery temperature is not allowed (temperature is ≤ -5 °C of ≥ +55 °C)

Status Byte "UPS info"	
Bit No.	**Description**
D0	Status: 1 = The UPS is in standby mode, the buffered supply is powered vis the +24 V main supply while the battery is connected.
D1	Status: 1 = The UPS is active, the buffered supply is provided from the battery.
D2	-
D3	Status warning: 1 = The battery is almost empty (Batter voltage with load ≤12.8 V)
D4	-
D5	Error: 1 = The battery is almost empty (Batter voltage with load ≤12.8 V)
D6	Error: 1 = The discharge current is too high (discharge current > 3.5 A)
D7	-

- For the status bits linked with battery voltages (e.g. battery info D3 ≤13.2 V) voltages measured under load are always used.

- If the device is powered by the +24 V main supply (UPS is in standby), only the voltage measured under the test load is used.

- If the device is powered by the battery however (UPS active), the battery voltage without an additional test load is used.

A battery is considered NOT connected when the status bits

- UPS info D0 (UPS standby) = 0
- UPS info D1 (UPS active) = 0
- UPS info D5 (battery almost empty or not connected) = 1

Any other combination of status bits means: The battery is connected.

EGetShutdownTime		
Description	**Request-ID**	**Instruction Sequence**
Read the current time settings from UPS active to the shutting down of Windows.	0x04	• Open connection • Send 4-byte Request-ID (0x04) to Pipe • Read 4-byte answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1-4	DWORD	Shutdown time setting in seconds

EGetShutdownTimerActive		
Description	**Request-ID**	**Instruction Sequence**
Read whether the shutdown time is active (UPS is active and the shutdown timer is counting)	0x05	• Open connection • Send 4-byte Request-ID (0x05) to Pipe • Read 1-byte (boolean) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = Timer is inactive TRUE timer is active

EGetTimeTillShutdown		
Description	**Request-ID**	**Instruction Sequence**
Read the time remaining until Windows shutdown	0x06	• Open connection • Send 4-byte Request-ID (0x06) to Pipe • Read 4-byte answer • Close connection

Answer

ByteNo.	Data type	Info
1-4	DWORD	Time remaining until Windows shutdown in seconds

EGetComPort		
Description	**Request-ID**	**Instruction Sequence**
Read the selected serial interface	0x07	• Open connection • Send 4-byte Request-ID (0x07) to Pipe • Read 4-byte long X of the following string • Read X-byte string (ASCII) answer • Close connection

Answer

ByteNo.	Data type	Info
1-4	DWORD	Length of the string to read, which contains the name of the serial interface.
5-5+X-1	BYTE[X]	String of the port name in ASCII characters (e.g. "\\.\COM1")

EGetAutoShutdownEnabled		
Description	**Request-ID**	**Instruction Sequence**
Read whether the Windows shutdown is enabled by the Windows service.	0x08	• Open connection • Send 4-byte Request-ID (0x08) to Pipe • Read 1-byte (boolean) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = automatic shutdown of windows disabled TRUE = automatic shutdown of windows enabled.

EGetCableType		
Description	**Request-ID**	**Instruction Sequence**
Read the battery extension cable type setting	0x09	• Open connection • Send 4-byte Request-ID (0x08) to Pipe • Read 1-byte answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BYTE	0: Typ0 = battery connected directly 1: Typ1 = not used 2: Typ2 = battery extension cable (1 meter) 3: Typ3 = not used 4: Typ4 = not used

5.5.2 Named-Pipe Write Function

Functions Overview Configuration of the SigmatekUpsMonitor Windows service monitor:		
Name	**Request-ID**	**Description**
ESetShutdownTime	0x80	Sets the time from the main supply failure to the automatic shutdown of Windows. Default: 20 seconds
ESetComPort	0x81	Sets the serial interface for the UPS. Default: \\.\COM1
EEnableAutoShutdown	0x82	Enable/disable the automatic Windows shutdown. Default: Enabled.
ESetCableType	0x83	Sets the battery extension cable type used. Default: Type 0 (battery connected directly)
EResetBatteryExchangeNeeded	0xC0	Resets the "Battery exchange needed" warning from the Pipe read function "EGetBatteryExchangeNeeded".

ESetShutdownTime		
Description	**Request-ID**	**Instruction Sequence**
Sets the "UPS active time" until the automatic Windows shut-down.	0x80	• Open connection • Send 4-byte Request-ID (0x80) to Pipe • Send 4-byte "UPS active" time in seconds until shutdown • Read 1-byte (boolean) answer • Close connection

Answer

ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = Error TRUE = The shutdown time was set in the configuration

ESetComPort		
Description	**Request-ID**	**Instruction Sequence**
Sets the serial interface for the UPS.	0x81	• Open connection • Send 4-byte Request-ID (0x81) to Pipe • Write 4-byte long X of the following string • Write X-byte string (ASCII) (e.g. „\\.\COM1“) • Read 1-byte (boolean) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = Error TRUE = the serial interface was set in the configuration

EEnableAutoShutdown		
Description	**Request-ID**	**Instruction Sequence**
Enable/disable the automatic shutdown of Windows by the SigmatekUpsMonitor Windows service	0x82	• Open connection • Send 4-byte Request-ID (0x82) to Pipe • Send 1-byte (Boolean) to Pipe • TRUE = enabled, FALSE = disabled • Read 1-byte (boolean) answer • Close connection

Answer		
ByteNo.	**Data type**	**Info**
1	BOOL	FALSE = Error TRUE = The automatic shutdown was enabled/disabled in the configuration

ESetCableType		
Description	**Request-ID**	**Instruction Sequence**
Sets the battery extension cable type used.	0x83	• Open connection • Send 4-byte Request-ID (0x04) to Pipe • Send 1-byte cable type to Pipe 0x00 = Type0 = battery connected directly 0x01 = Type1 = not used 0x02 = Type2 = battery extension cable (1 meter) 0x03 = Type3 = not used 0x04 = Type4 = not used • Read 1-byte (boolean) answer • Close connection

Answer

ByteNo.	Data type	Info
1	BOOL	FALSE = Error TRUE = The cable type was enabled/disabled in the configuration

EResetBatteryExchangeNeeded		
Description	**Request-ID**	**Instruction Sequence**
Resets the "Battery exchange needed" warning from the EGet-BatteryExchangeNeeded Pipe function.	0xC0	• Open connection • Send 4-byte Request-ID (0x04) to Pipe • Read 1-byte (boolean) answer • Close connection

Answer

ByteNo.	Data type	Info
1	BOOL	FALSE = Error TRUE = The Battery exchange needed" status was reset

5.6 Battery Charging Process

According to the battery manufacturer's recommendation, the following cyclic charging process is used with circa C/20 charging rate to maximize the life span of the battery.

A charging rate of C/20 corresponds to 1/20 of the battery capacity (1100 mAh / 20 = 55 mA)

This is the typical charging rate for long-term charging processes of NiMH batteries.

The battery charging circuit is activated:

- If the main supply is on. A 24 h continuous charging cycle is started.
- After a charging pause of 24 hours. After the first 24-hour charging cycle, the system switches to a pulsed charging cycle and every 24 h, an 8-h continuous charging cycle is performed to maintain the voltage (see image 1 & 2).

The charging circuit is deactivated:

- If the device is powered by the battery (main voltage supply failure).
- If the actual charging time (24 h / 8 h, see image 1 & 2) is exceeded.
- The charging current falls to <= 30 mA.

5.6.1 Time Specification

Example of the time response of the charging circuit with a continuously powered ETV 1591-H:

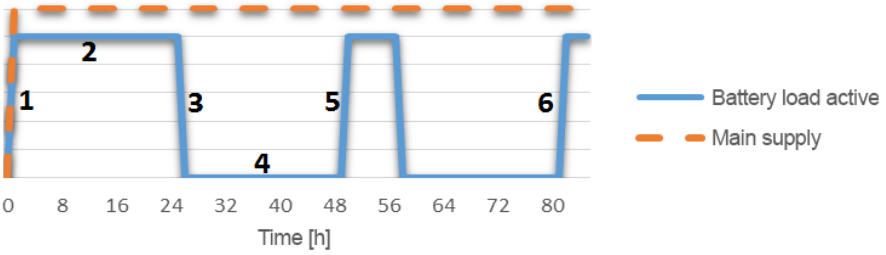


Image 1

1 → Start of 24 h charging by turning on the main supply
2 → 24 h battery charging
3 → 24 h charging ended
4 → 24 h charging stop
5 → Start of 8 h charging after 24 hour charging stop (pulsed charging)
6 → Start of 8 h charging after 24 hour charging stop (pulsed charging)

5.6.2 Measuring

In the image 2 diagram, an ETV 1591-H is continuously powered with 24 V and the charging cycle is thereby recorded.

The cycles correspond to the time specifications.

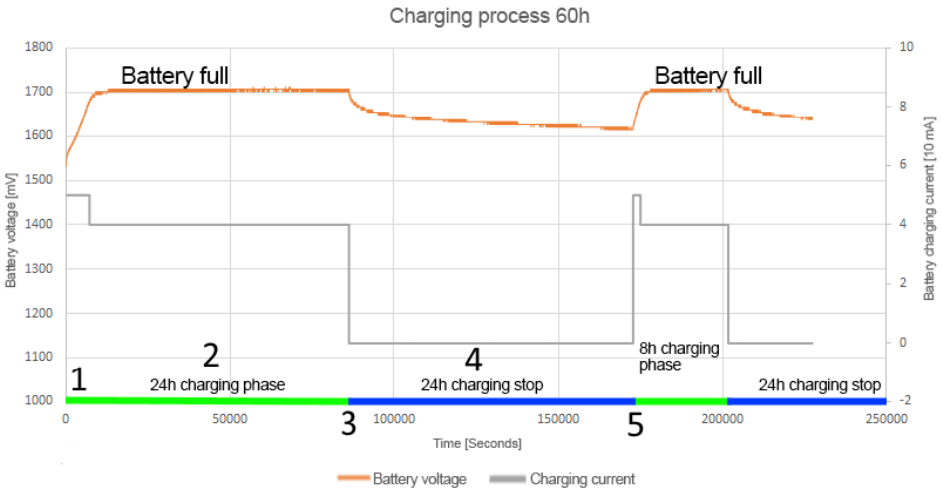


Image 2

1 → Start of 24 h charging by turning on the main supply
2 → 24 h battery charging
3 → 24 h charging ended
4 → 24 h charging stop
5 → Start of 8 h charging after 24 hour charging stop (pulsed charging)

Orange curve – battery voltage

- While the battery is charging (2): The curve corresponds to the charging voltage in the battery

- The battery voltage is constant as soon as the battery is full.

- During the charge stop (4): the curve corresponds to the open circuit voltage of the battery Due to the battery cell characteristics, the battery voltage without charging current is produced (chemical and thermal response).

Gray curve charging current:

- While the battery is charging (2): in the flat section of the battery voltage, the battery is recharged (current 40 mA) although it is already full. This is then a floating charge and has no disadvantages for the NiMh battery.

5.7 Battery Lifespan and Charge/Discharge Curve

The following chapter contains information on the battery lifespan, self-discharge and information on the voltage curve of the battery while charging/discharging.

5.7.1 Battery Lifespan

- The battery is charged/discharged according to manufacturer specifications. With the cyclic charging process used, a battery lifespan of at least 6 years can be ensured.

- The battery type used has over chargeable cells. The UPS system implemented limits the voltage and current, thereby providing double protection for the battery.

- With the integrated deep discharge protection (limit 12.3 V), the lifespan is also ensured.

- If one or several battery cells should still be defective, there is a safety valve to allow the over pressure in battery to be safely dissipated. The cells are therefore prevented from exploding.

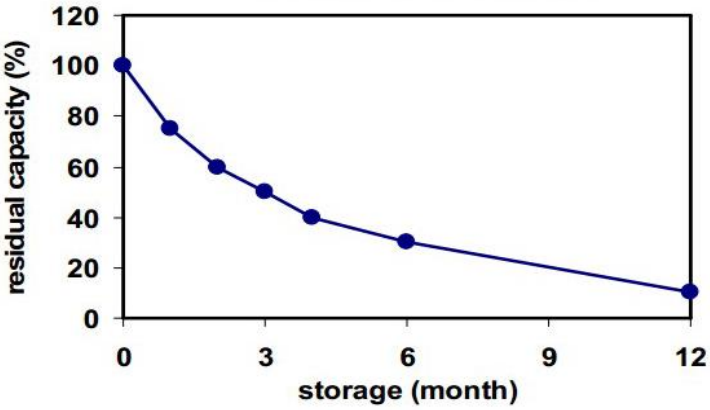
- Since the current in the batter pack is limited via PTC, the battery pack cannot overheat in the event of a short circuit.

- If a short circuit condition exists for too long a time however, irreversible damage can be caused by deep discharging of the cells (the PTC in the battery is high ohmic, but the battery will still discharge).

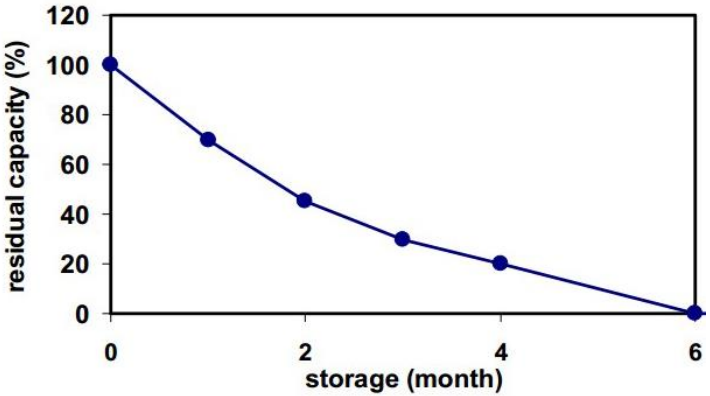
5.7.2 Self-Discharge

A battery is not destroyed by self-discharge and its lifespan is not affected. Operating with a discharged battery also does not destroy it, however, there is also no buffer time available for the target hardware (battery deep-discharge protection).

Self-discharge curve of a fully charged battery at a storage temperature of ~25 °C.

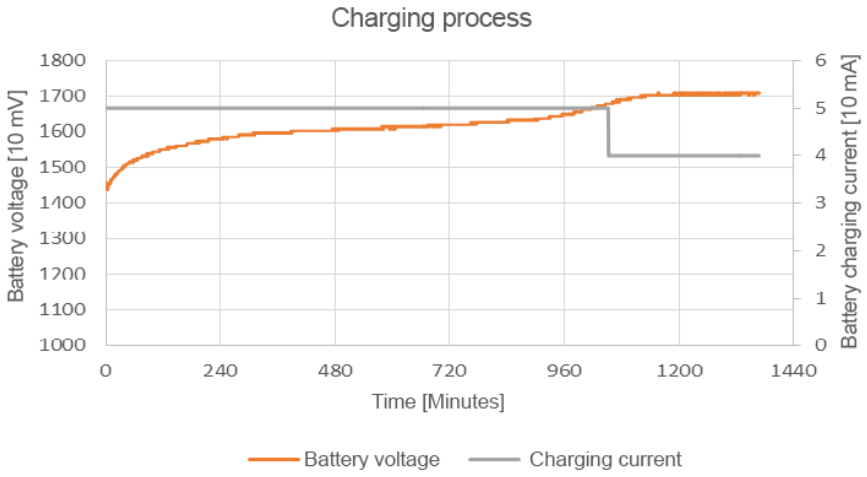


Self-discharge curve of a fully charged battery at a storage temperature of ~40 °C.



5.7.3 Battery Charging Curve

In the following diagram, the battery was charged for period of 22 h in the ETV 1591-H. The battery voltage and charging current measured by the UPS were recorded during the charging process.



Orange curve: battery voltage

- After a charging time of approximately 18 hours, the battery reaches the maximum possible charge (can be seen on the orange, flat voltage drop after 18 hours).

- Because to the very flat charging voltage curve, the battery status and the charged capacity cannot be reliably specified.

Gray curve: charging current

- After approximately 18 hours, the current sinks to a 40 mA floating charge (see battery charging current diagram, curve: 5 to 4).

Battery full:

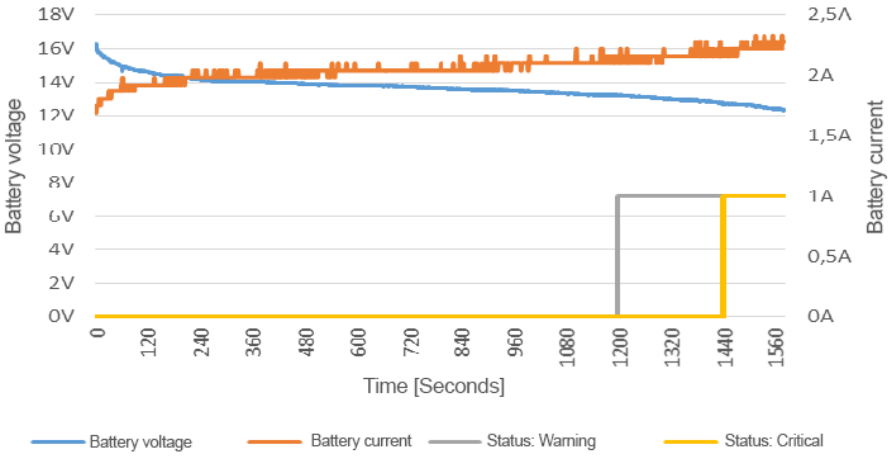
- The NiMh battery can only be determined as full over a total charging time of 28 hours. This loading time is measured in the Windows service and the status set according to the application.

- If the charging current is ≤30 mA, the UPS hardware ends the charging process before the cycles are complete since the battery is full. This corresponds to the charging stop. From this point, the 24 h charging stop begins (see cycles).

5.7.4 Battery Discharging Process

The discharge curve of a fully loaded battery is measured up to the deep-discharge threshold. The test device is the ETV 1591-H in normal operating mode at room temperature. After turning off the +24 V main supply, the recording begins. Deactivating the UPS after 60 seconds of buffering is disabled for this measurement.

The voltages and currents measured by the UPS were recorded during the discharge process.



Blue curve: battery voltage

- After the first 10% of the discharge time to the deep discharge threshold, the battery voltage has a flat curve

Orange curve: battery current

- The current from the battery increases while the battery voltage sinks (the power in the buffered supply remains constant).

Grey and yellow: "Status: Warning" and "Status: Critical" are based on the battery voltages 13.2 V (warning) and 12.8 V (critical warning). The measurement makes it clear that a fully charged battery has sufficient reserves for several subsequent buffering processes.

Even when the battery reaches a low charge, buffering capacity is still available.

5.8 Battery Extension Cable

Using an extension cable, the battery can be located away from the device; the extension cable must be connected between the battery and the ETV 1591-H.

However, the cable and the additional connector must be included in the calculation of the battery voltage measurement. The UPS calculates the voltage drop.

The UPS is configured via the Windows service "SigmatekUpsMonitor". For the configuration of the cable type, see the chapter "Named Pipe Write Functions".

Order number for the battery extension cable (1 meter): 01-940-010

5.9 Battery Exchange

The "SigmatekUpsMonitor" method to evaluate the battery for the "Battery exchange needed" status and instructions for exchanging it.

5.9.1 Exchange Battery Status

The battery is evaluated by the Windows service "SigmatekUpsMonitor" when the main supply is turned off. The status "Battery must be exchanged" can then be read via the Named Pipe Windows service.

A battery is described as defective when the voltage, despite sufficient charging time, falls below a specific limit with connected to a load.

Reasons: Because of reduced capacity due to aging or improper use of the battery, the voltage drops faster than normal when under load.

After the system start, the battery must charge continuously for 5 hours to ensure that the Windows service runs the evaluation of the "Battery exchange needed" status.
Recommendation: an evaluation of the battery should be performed weekly.

For the evaluation of the battery, one of the two following conditions are required:

- The battery must be continuously charged for at least 5 hours (detection of "battery is fully charged" via time condition).

- The charging current has sunk to 30 mA during the charging phase (detection of "battery fully charged" via charging current. depending on ambient conditions, this case should not occur).

In addition, the following condition must always be met:

- The USV must be active due to a main power loss, this means that the device must be powered by the battery (status bit "The UPS is active"). The battery is not evaluated when the system is not shut down by a loss of main power, but for example, with [ALT] + [F4] -> [shut down].

The Windows service sets the status "Battery exchange needed" when:

- The main supply has failed and

- At the same time, during the "SigmatekUpsMonitor" Windows service runtime, the battery voltage drops below 13.2 V. This guarantees that the loss of the actual 24 V supply can still be buffered without error.

The circa last 5 seconds until the UPS deactivates the buffered supply and is no longer detected by the Windows service, has no effect on the correct evaluation.

5.9.2 Exchanging the Battery

The battery is exchanged with the entire battery housing. The 4 mounting screws on the battery housing must be removed. (Note: the 4 clearance bolts between the battery pack and the housing must be secured with the screws when mounting the battery pack).

The battery can only be exchanged when no voltage is applied!

Order number for the replacement V02 battery pack: 01-690-068-2

6 Digital In and Outputs

The IPC has 4 digital short-circuit proof outputs of +24 V / 2 A each (positive switching) as well as 4 digital 24 V / 5 mA / 5 ms inputs to detect the signal conditions 0 and 1.

In compliance with the safety-relevant requirements of the BG Institute for Occupational Safety (BIA), the outputs on the primary (+5 V) and the secondary (+24 V) sides are isolated using optic couplers (according to application class 3, pollution degree 2).

For the inputs, the primary (+24 V) and the secondary sides (+5 V) are separated using optic couplers. In the monitoring circuits of the voltage supply for each channel group, the primary (+5) and secondary (+24) sides are also isolated with optic couplers.

GND and EXTGND are not galvanically isolated (for safety reasons, not required). The clearance between conductor paths complies with UL regulations.

6.1 General Information on the Digital Outputs

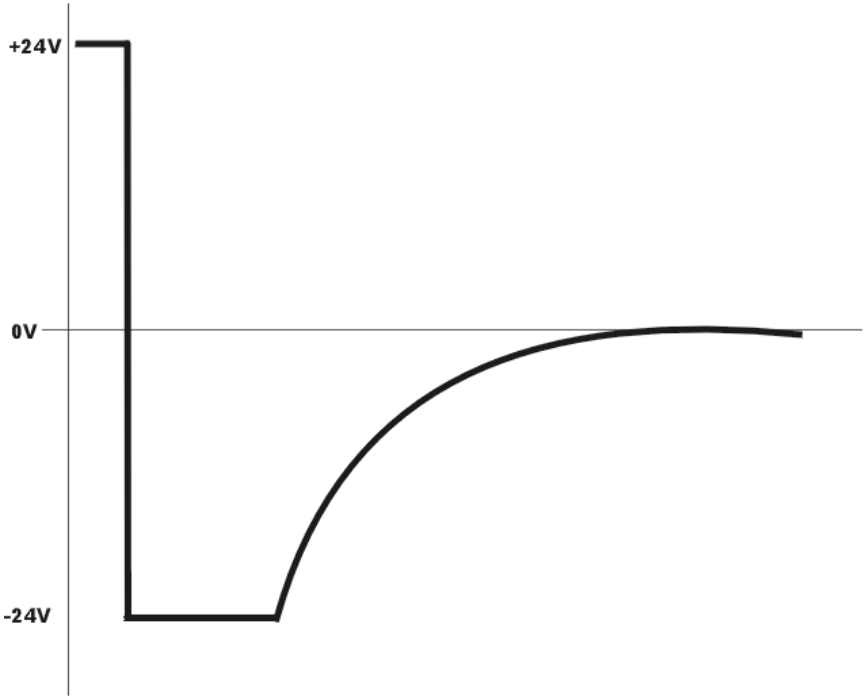
Up to 4 outputs are powered by a common +24 V supply. The cross section of the +24 V and 0 V supply must be designed for the maximum output current drawn by a group.

Caution!

When inductive loads are not equipped with a protective circuit, the high surge current flows over the 0 V line when the load is disconnected since the internal protective circuit is wired against 0 V An excessively long or too thin 0 V conductor can lead to undesired responses from the outputs of the affected module.

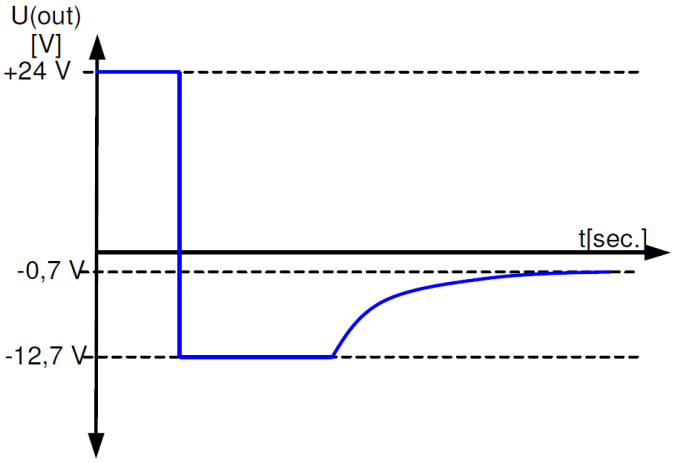
The outputs can be turned off by disconnecting the +24 V supply voltage. Applying power to an output whose supply voltage exceeds 0.7 V is not allowed. All outputs are electrically protected against +24V. Braking of inductive loads is limited to -24 V as shown in the graph below. A Protective circuit connected directly to the inductive load is recommended however, to avoid system disruptions through voltage spikes (cross talk on analog lines). However, this results in the internal voltage limit being effective only up to -0.6 V.

6.2 Disconnecting Inductive Loads



6.3 Additional Protective Circuit

Each group of 4 outputs is also protected internally against 24V/3 to 24V/4. Braking of inductive loads is limited to – 12.7 V as shown in the graph below. However, an additional protection circuit directly on inductive loads is recommended (freewheeling diode) to avoid a system failure caused by voltage spikes (cross talk on analog lines). However, this results in the internal voltage limit being effective up to -0.7 V only.

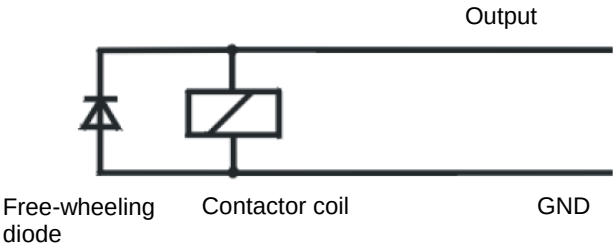


6.4 Wiring Guidelines for the Digital Outputs

A careful wiring method is recommended to ensure error-free function. The following guidelines should be observed:

- Avoid parallel wiring between input lines and load-bearing circuits.
- Protective circuits for all relays (RC networks or free-wheeling diodes)
- Correct wiring to ground

6.4.1 Connecting Inductive Loads



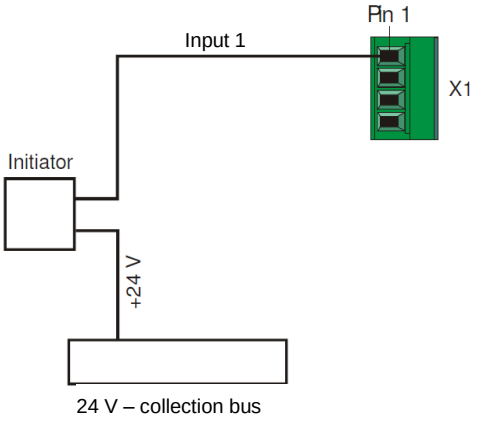
6.5 Wiring Guidelines for the Digital Inputs

The input filters, which suppress noise signals, allow operation in harsh environmental conditions. A careful wiring method is also recommended to ensure error-free function.

The following guidelines should be observed:

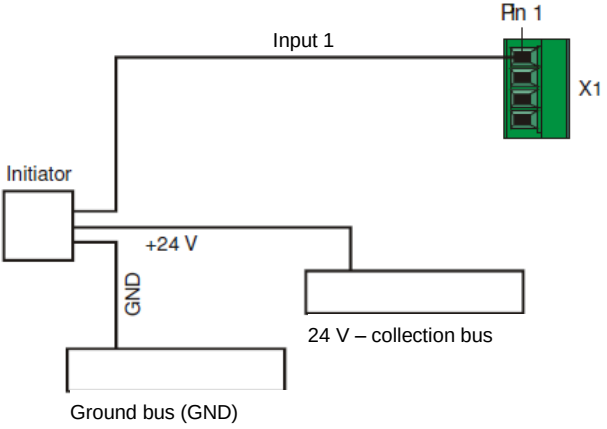
- Avoid parallel connections between input lines and load-bearing circuits.
- Protective circuits for all relays (RC networks or free-wheeling diodes)
- Correct wiring to ground
- The GND connection for the inputs and current supply module must be connected to a common earth bus over the shortest route possible.
- The earth bus should be connected to the switch box when possible!
- Connecting the Signal Sensor

6.5.1 2-wire Initiators and Mechanical End Switches



Schematic 2

6.5.2 3-wire Initiators



Schematic 3

7 Buffer Battery

The exchangeable buffer battery ensures that the clock time (RTC) is preserved in the absence of a supply voltage. A lithium battery is installed at the manufacturer.

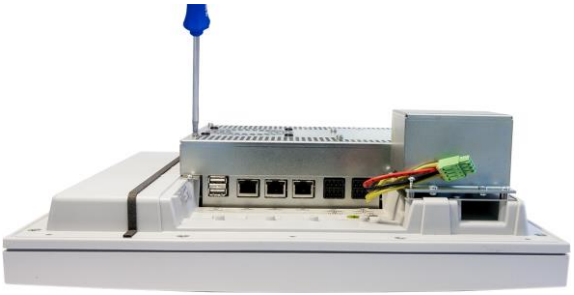
The battery has enough capacity to preserve data in the absence of a supply voltage for up to 4 years.

Battery order number: **01-690-067**

	MANUFACTURER	DATA
Lithium battery	VARTA	3.0 V 1.0 Ah

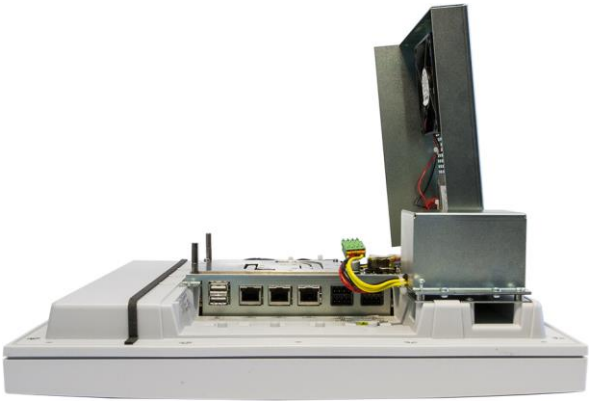
WARNING!
Battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire.
Replace Battery with Cat. No. CR1/2AA manufactured by VARTA only.
Use Of Another Cell May Present A Risk Of Fire Or Explosion.
Battery replacement has to be made by a qualified technician!

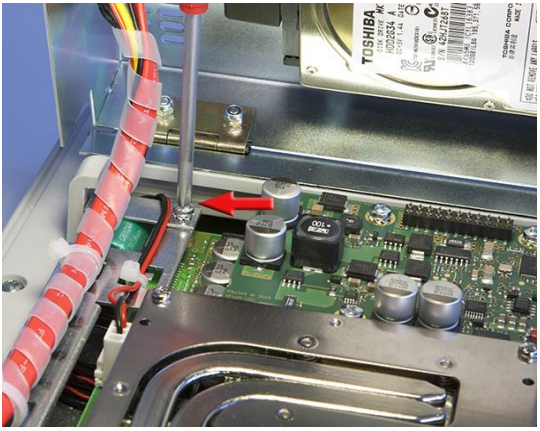
8 Exchanging the Battery / Hard Drive



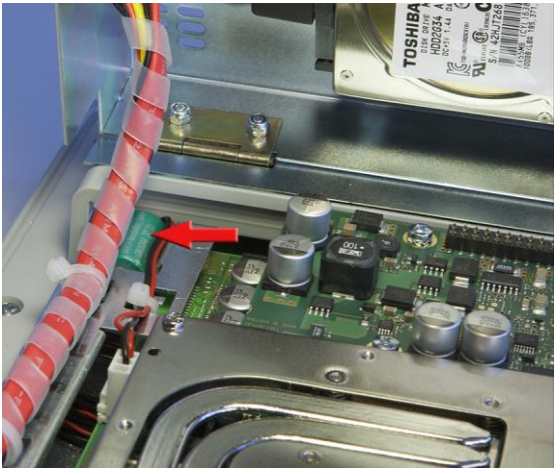
Disconnect the power to the ETV.

Open the locking screws on the back of the terminal with a PH-1 screwdriver:

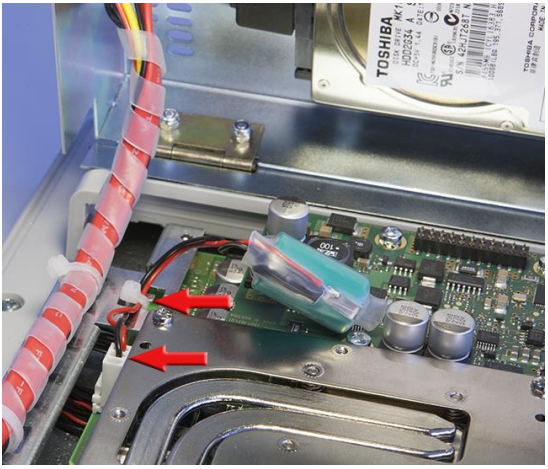




Open the locking screws of the battery lock with a PH-1 screwdriver:



Carefully remove battery



Loosen the cable binders and disconnect battery plug.

Next, connected the new battery, secure it with cable binders and place it in the provided holder. Finally, replace the battery lock.

9 Cooling

The terminal's power loss can reach up to 10 Watts. To ensure the necessary air circulation for cooling, the following mounting instructions must be followed!

10 Mounting Instructions

The following distance from the housing should be maintained:

Rear side, left and right 5 cm

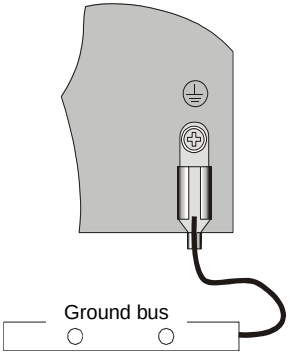
Above and below 10 cm

A mounting position of 60° to 120° is also required.

11 Wiring Guidelines

11.1 Ground

To ensure that the display unit functions error-free, the blade terminal on the back panel must be connected to the earth bus. It is important to create a low-ohm ground connection, only then can error-free operation be guaranteed. The earth connection should have a maximum cross section and the larges (electrical) surface possible.



11.2 Shielding

For the Ethernet, CAT5 cables with shielded RJ45 connectors must be used. The shielding on the CAT5 cable is connected to ground over the RJ45 plug connector. Noise signals can therefore be prevented from reaching the electronics and affecting the function.

11.3 ESD Protection

Typically, USB devices (keyboard, mouse) are not equipped with shielded cables. These devices are disrupted by ESD and in some instances, no longer function.

Before any device is connected to, or disconnected from the terminal, the potential should be equalized (by touching the control cabinet or earth terminal). This will allow the dissipation of electrostatic loads (caused by clothing/shoes).

11.4 USB Interface Connections

The terminal has at least one USB interface. The terminal has a USB interface connection that can be used to connect various USB devices (keyboard, mouse, storage media, hubs, etc.) in Windows. Using a hub, several USB devices can be connected that are then fully functional in Windows.

12 Recommended Shielding for VARAN

The VARAN real-time Ethernet bus system exhibits a very robust quality in harsh industrial environments. Through the use of IEEE 802.3 standard Ethernet physics, the potentials between an Ethernet line and sending/receiving components are separated. In the event of an error, the VARAN Manager resends messages to a bus participant immediately. The shielding described below is mainly recommended.

For applications in which the bus is operated outside the control cabinet, the correct shielding is required. This is especially important, if due to physical requirements, the bus cables must be placed next to sources of strong electromagnetic noise. It is recommended to avoid placing VARAN bus lines parallel to power cables whenever possible.

SIGMATEK recommends the use of CAT5e industrial Ethernet bus cables.

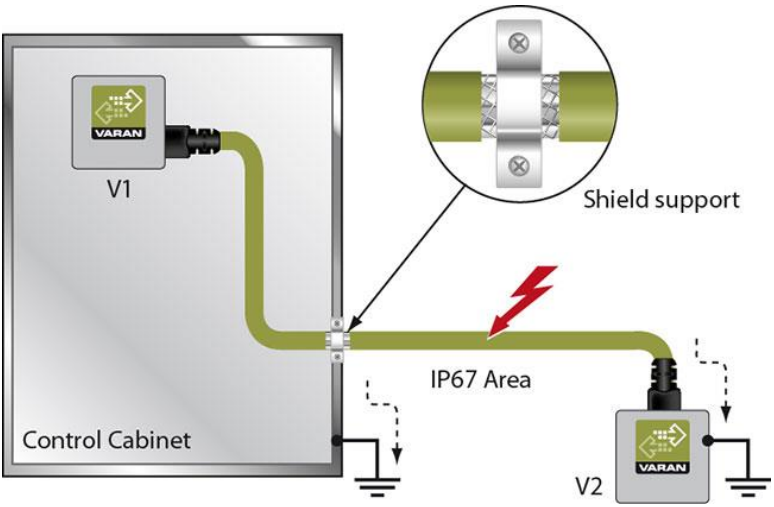
An S-FTP cable should be used for the shielding.

An S-FTP bus is a symmetric, multi-wire cable with unshielded pairs. For the entire shielding, a combination of foil and braiding is used. A non-laminated variant is recommended.

The VARAN cable must be secured at a maximum distance of 20 cm from the connector to protect against vibration!

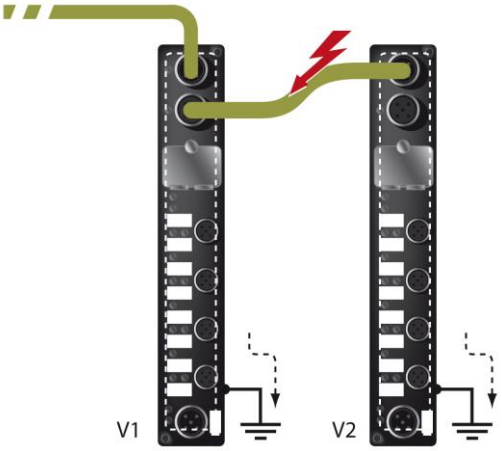
12.1 Wiring from the Control Cabinet to an External VARAN component

If the Ethernet lines are connected from a VARAN component to a VARAN node located outside the control cabinet, the shielding should be placed at the entry point to the control cabinet housing. All noise can then be deflected from the electronic components before reaching the module.



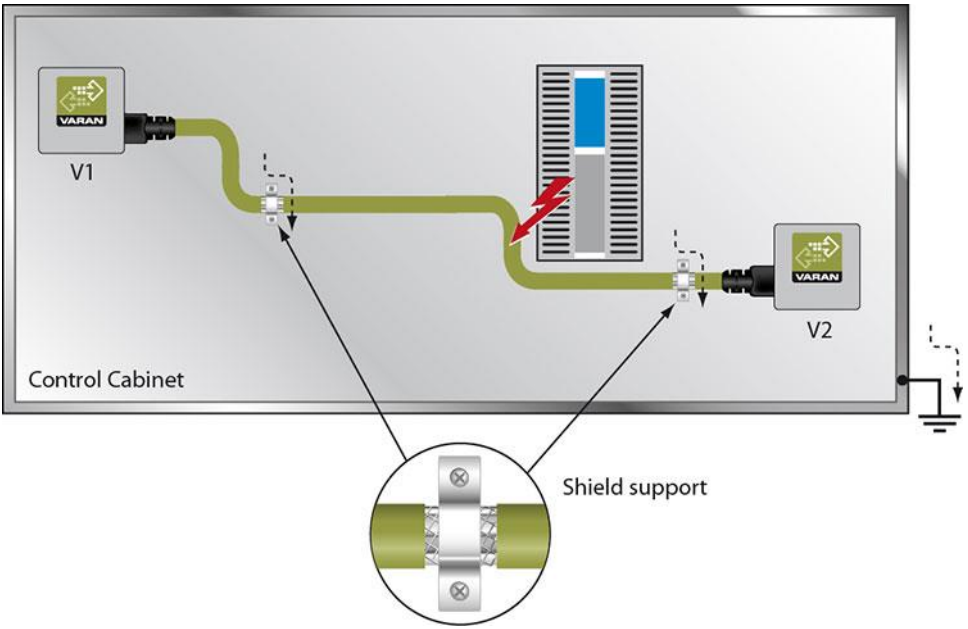
12.2 Wiring Outside of the Control Cabinet

If a VARAN bus line must be connected outside of the control cabinet only, no additional shield support is required. A requirement therefore, is that only IP67 modules and connectors can be used outside the control cabinet. These components are very robust and noise resistant. The shielding for all sockets in IP67 modules are internally connected to common bus or electrically connected to the housing, whereby the deflection of voltage spikes does not flow through the electronics.



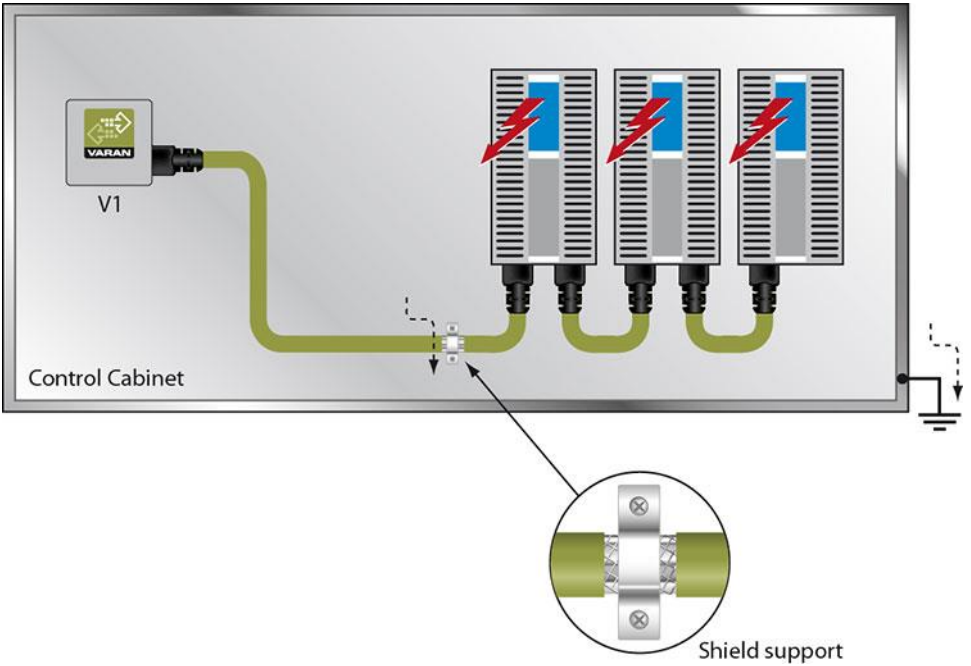
12.3 Shielding for Wiring Within the Control Cabinet

Sources of strong electromagnetic noise located within the control cabinet (drives, Transformers, etc.) can induce interference in a VARAN bus line. Spike voltages are dissipated over the metallic housing of a RJ45 connector. Noise is conducted through the control cabinet housing without further action from the electronic components. To eliminate sources of noise during data transfer, it is recommended that the shielding for all electronic components be connected within the control cabinet.



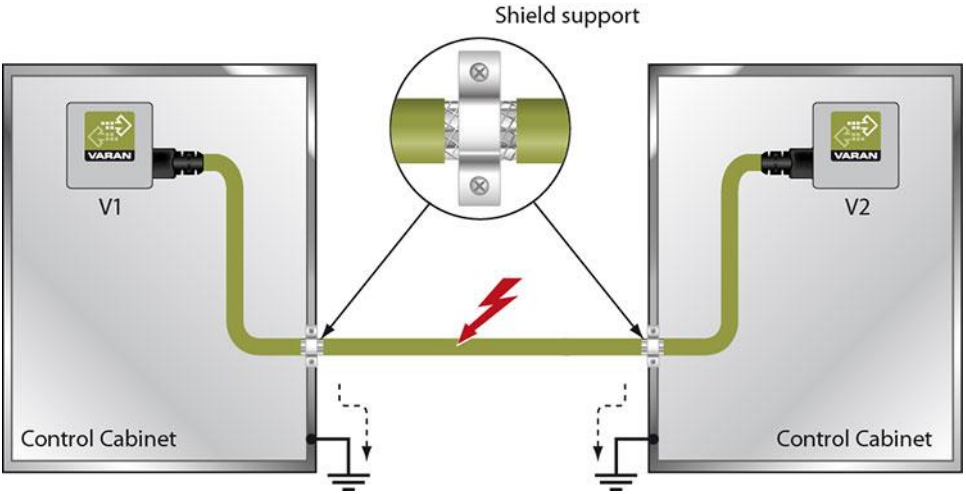
12.4 Connecting Noise Generating Components

With the connection of power components that generate strong electromagnetic interference, it is also critical to ensure correct shielding. The shielding should be placed before a power element (or group of power elements).



12.5 Shielding Between Two Control Cabinets

If two control cabinets must be connected over a VARAN bus, it is recommended that the shielding be located at the entry points of both cabinets. Noise can be thereby prevented from reaching the electronics within the control cabinet.



13 Cleaning the Touch Screen

CAUTION!
Before cleaning the touch screen, the terminal must first be turned off to avoid unintentionally triggering functions or commands!

The terminal's touch screen can only be cleaned with a soft, damp cloth. A screen cleaning solution such as an anti-static foam, water with a mild detergent or alcohol should be used to dampen the cloth. The cleaning solution should be sprayed onto the cloth and not directly on the terminal. The cleaning solution should not be allowed to reach the terminal electronics, for example, through the ventilation slots.

No erosive cleaning solutions, chemicals, abrasive cleansers or hard objects that can scratch or damage the touch screen may be used.

If the terminal comes in contact with toxic or erosive chemicals, clean the terminal immediately and with caution to prevent acid damage.

To ensure the optimal function of the terminal, the touch screen should be cleaned at regular intervals!

To extend the lifespan of the touch screen as much as possible, using the fingers to operate the terminal is recommended.

Documentation Changes

Change date	Affected page(s)	Chapter	Note
11.04.2013	12 24 29	4.2 Rear connectors 5.5.3. COM Port Initialization 5.6.5. Set cable type	connector encoding for graphics added Chapter added Chapter edited
05.06.2013		Entire documentation	UPS description expanded and corrected
03.02.2014	7 15 16 17 18 21 32 33	1.2 Electrical Requirements 5 UPS 5.1 Block Diagram 5.2.1 Performance Data 5.2.2 Electrical Requirements 5.2.3 Environmental Cond. 5.5 UPS Switching Point and 5.6 Charging Circuit / Time / Current 5.9 Battery Exchange 6 Digital In and Outputs	5 A changed to 4 A Changed from circa to max. 1 minute Block diagram changed Internal energy storage, constant current changed Supply voltage and current consumption changed Note changed Voltages and notes changed expansions and article number of battery pack Text edited
03.02.2014	7 8 40	1.2 Electrical Requirements 1.7 Miscellaneous 7 Buffer Battery	Added Supply voltage (UL) Added Standard UL 508 (E247993) Changed battery exchange description in grey box
05.11.2014	6 7 14 to 36	1.2 Electrical Requirements 1.7 Miscellaneous 5 Uninterruptable Power Supply UPS	Changed Supply voltage (UL) to 20-30 V DC (Class 2) Changed Hardware version to 2.x Updated complete chapter
23.03.2015	6	1.2 Electrical Requirements	Changed Supply voltage