	Mini-PLC STG-700 Art. No. 0850-0700	MANUAL	Page: 1/8 Document: 9021-0017-A Date: 10.08.2016 Revision: A

BARTH® Elektronik GmbH

Mini-PLC STG-700
Art. No. 0850-0700

MANUAL

TABLE OF CONTENT

1 SAFETY INSTRUCTIONS

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and the connected equipment. These notices are highlighted in the manual by a warning symbol and are marked as follows according to the level of danger:

Only qualified personnel should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment and systems in accordance with established safety practices and standards.

Turn off the power supply before performing any wiring operations! Short circuits can be harmful, critical and can cause explosions and serious burns!

Please read this manual carefully and observe all safety instructions!

2 DESTINATED USE

The Mini-PLC is designed for universal measuring, controlling and regulating applications.
It must not be used for life critical, medical or fail safe applications.

3 DISCLAIMER

BARTH Elektronik GmbH assumes no liability for usage and functionality of the Mini-PLC in case of disregarding this manual. The strict accordance of this manual is important since the installation methods, peripheral connections, usage and maintenance can not be controlled by BARTH Elektronik GmbH. Therefore BARTH Elektronik GmbH assumes no liability for any claim.

4 PRODUCT DESCRIPTION

The picture below shows the BARTH® Mini-PLC STG-700 with the connection cable VK-16 (Art. No. 0019-0016). The Mini-PLC is shipped without the USB connection cable VK-16.

4.1 Features

- 2 analog Inputs 0 to 30 VDC, 12 bit ADC
- 2 digital Inputs up to 1 kHz
- 4 Power Outputs up to 1.5 A
- 1 CAN 2.0A/B Interface
- Stepper Motor Output 1.5A bipolar
- Reliable Solid-State Outputs
- Fail Safe Oscillator
- Programmable Status LED
- TTL-232/USB Connection to PC
- Intuitive graphical Programming Capability
- Wide Operating Voltage Range 8 to 32 VDC
- Wide Operating Temp. Range -40 to +50°C
- Vibration resistant and rugged Sealing
- Protection Grade IP 66
- Engineered and manufactured in Germany

4.2 Applications

- Industrial Automation
- Building Automation
- Process Control

4.3 General description

The brandnew STG-700 integrates a powerful stepper motor controller with an ultrcompact Mini-PLC in a splashproof aluminium diecast housing.
The graphical programming capability, universal I/Os and a CAN interface open up a variety of industrial and also battery-powered 12/24V applications.
For example, the STG-700 is able to control a large format analog display using a bipolar stepper motor converting an analog or digital input signal to a corresponding motor angle. Also x-by-wire systems can be realized using the STG-700 as both control and stepper driver unit.
As the STG-700 is fully integrated in a splasproof aluminium diecast housing, additonal housings will be not necessary. This fact makes the Mini-PLC ideal for applications within harsh environment.
The STG-700 is also available as customer-tailored OEM version.

4.4 Programming with miCon-L

Without learning a difficult programming language the BARTH® Mini-PLC can be easily programmed using simple and vivid graphical function blocks. This block design meets graphical standards of the latest graphical programming languages.

The miCon-L software suite features CAN and STEPPER programming, simulation and test in one unique software design tool. The flexible programming option offers a variety of possibilities in industrial applications.
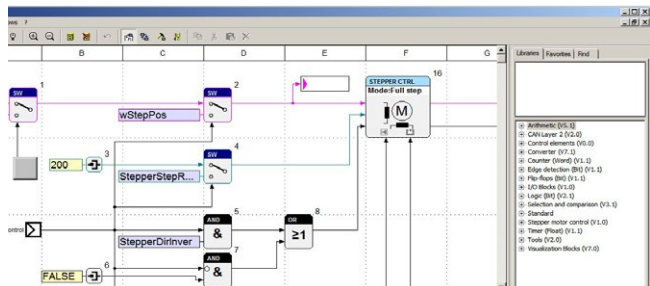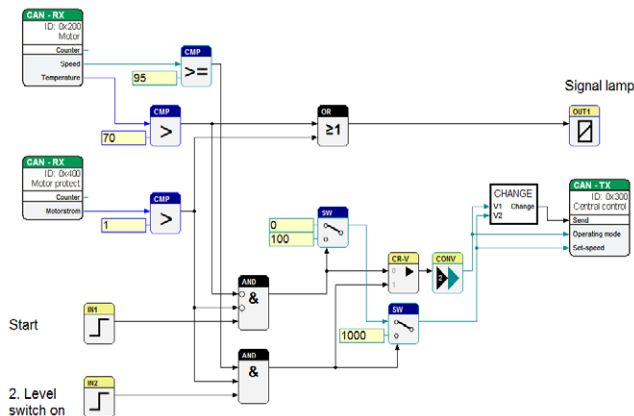
Programming the STG-700 follows using the USB port of your PC with installed miCon-L software suite and the VK-16 USB Connection Cable. The miCon-L Software supports full simulation and visualisation operation modes.

miCon-L provides a variety of visualisation blocks and interactive elements to control and debug the Mini-PLC.
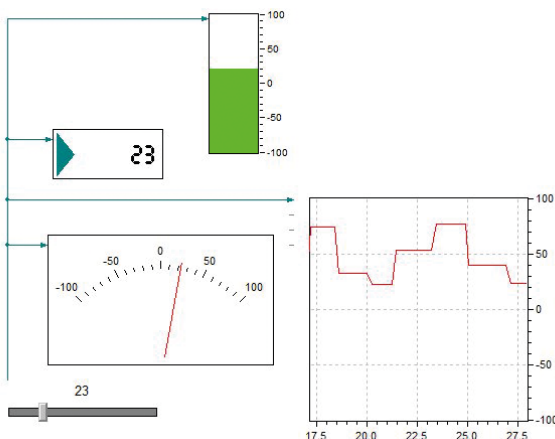
For detailed information please read the BARTH® miCon-L manual and the BARTH® Application Notes on:

www.micon-l.de
www.barth-elektronik.de

4.5 Delivery content

- BARTH® Mini-PLC STG-700
- Screw-type terminal connectors

5 INSTALLATION

5.1 Mounting

| ⚠ | The Mini-PLC must be installed and wired by a trained technician who knows and complies with both the universally applicable engineering rules and the regulations and standards that apply in specific cases. |

Fastening the STG-700 follows using the integrated mounting holes underneeth the lid.
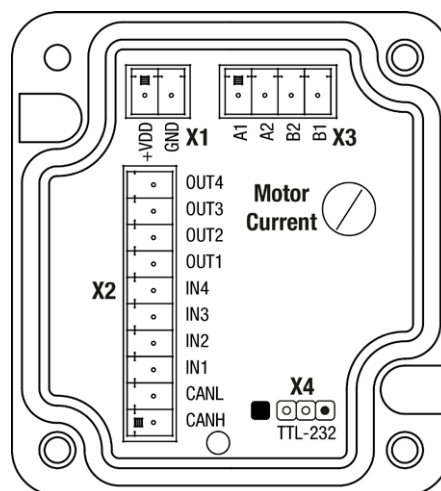
Take care to meet the environmental conditions of the STG-700.

5.2 Wiring

5.2.1 Overview

The graphic below shows the connection layout of the BARTH® Mini-PLC STG-700.

X1 connector: supply
X2 connector: inputs and outputs
X3 connector: stepper motor
X4 connector: TTL-232/USB interface (via VK-16)

5.2.2 Connecting the power supply

The STG-700 features an outstanding wide supply voltage range from 8 to 32 VDC at lowest current consumption.
So the Mini-PLC can be integrated within battery supplied 12V or 24V DC systems (cars, trucks, battery powered cars, forklifts and digger, for example).

> **Turn off the power supply before performing any wiring operations!**

> **False electrical connection, voltage reversal or disregarding the electrical specifications may cause irreversible damage of the Mini-PLC!**

Connect the supply voltage of 8 to 32 VDC to the 2-pole terminal X1 of the STG-700. Wire the positive supply to the VDD pin 1. Ground will be wired to the GND pin 2. All terminals are carried out as plugable screw-type terminal connectors for a wire gauge of 0.25 to 1.5mm².

> **Ensure correct power supply voltage range and polarisation! External fusing of 6A max. is mandatory! Disregarding may cause irreversible damage of the PLC!**

5.2.3 Connecting the inputs

You can connect sensors, switches or buttons to the inputs. The sensors may be temperature, flow, pressure, photo-electric sensors or proximity switches, for example.
The STG-700 is well suitable for any sensor featuring a voltage output, 0 to 10 VDC, for example.

Common features of the inputs
• IN1 and IN2 are selectable analog/digital inputs
• IN3 and IN4 are pure digital inputs (up to 1kHz)
• Wide input voltage range 0 to 32VDC
• IN1 and IN2 are 0 to 10 V compatible
• Comprehensive integrated protection circuits
• Outstanding electromagnetic compatibility (EMC)
• Electrostatic discharge protection (ESD)

Due to the pull-down resistors integrated in the STG-700 any switch (NO/NC) can simply be connected between the positive supply (VDD) of the STG-700 and the desired input.

> **The voltage at any input must not exceed 32VDC referred to ground (GND).**
> **Higher voltages or reverse voltage lower than -32VDC may cause irreversible damage of the Mini-PLC!**

The 10-pole connector named X2 contains the inputs of the Mini-PLC. While IN3 and IN4 are pure digital inputs, IN1 and IN2 provide both digital or analog (0-30V) functionality. The voltage range for all inputs may not exceed 32 VDC. All inputs refer to GND. Please refer to the appendix for detailed electrical specification of the inputs.

5.2.4 Connecting the outputs

Depending on load type and current the STG-700 is able to drive electric loads directly without any additional driver or protection circuit. The Mini-PLC provides 4 digital solid-state highside outputs and 1 stepper motor output.

Common features of outputs OUT1 to OUT4
• Rugged solid-state higside switch up to 1.5A
• Paralleling permissible up to 4A
• Short circuit protection and current limitation
• Fast demagnetization of inductive loads
• Stable behaviour at undervoltage
• Comprehensive integrated protection circuits
• Outstanding electromagnetic compatibility (EMC)
• Electrostatic discharge protection (ESD)

Features of stepper motor output
• Drives all bipolar stepper motors up to 1.5A
• Adjustable current limitation 0.1 to 1.5A
• 4 selectable step modes
• Rugged solid-state design

The 10-pole connector X2 contains the digital outputs of the Mini-PLC. OUT1 to OUT4 are overload-protected high-side switches. A logical HIGH within miCon-L will switch the Mini-PLS´s supply voltage at OUT1 to OUT4.

> **The total current sourced by OUT1 to OUT4 must not exceed 4A!**
> **Avoid reverse voltage at any output higher than the Mini-PLC´s supply voltage!**

Please refer to the appendix for detailed electrical specification of the outputs.

5.2.5 Connecting the Stepper Motor

The X3 connector of the STG-700 contains the stepper motor connection. Wire the motor to A1, A2, B1 and B2.

> **The voltage at A or B must not exceed -10 or +15 VDC referred to ground (GND). Higher voltages may cause irreversible damage of the Mini-PLC!**

Please adjust the desired motor current with the potentiometer. Take care to not exceed the maximum allowable motor current the manufaturer specifies.

5.2.6 Connecting the CAN interface

The X2 connector of the STG-700 contains the CAN pins ‚CANH‘ and ‚CANL‘.

> **The voltage at CANH or CANL must not exceed -27 or +40 VDC referred to ground (GND). Higher voltages may cause irreversible damage of the Mini-PLC!**

There is no termination resistor integrated in the STG-700. Please refer to the appendix for detailed electrical specification of the CAN interface.

6 OPERATION AND PROGRAMMING

6.1 Software download

BARTH® supplies a free software license download package for Microsoft® WINDOWS® which includes:

- Virtual COM port driver for USB connection
- miCon-L Software Suite
- Sample Programs for BARTH® Mini-PLC

Please download this package from:
www.micon-l.de

## 6.2 Virtual COM port driver installation

Before you connect the Mini-PLC to the PC you have to install the USB-/COM-port driver (folder ‚USBdriver') from the software download package. Please follow the instructions of the SETUP routine.

6.3 miCon-L Software Installation

Now install the miConL software suite from the ‚miCon-L' folder. Select your language file and follow the setup instructions of miConL.

6.4 Connecting the Mini-PLC

To operate the STG-700, first establish proper power supply connection to the X1 connector.
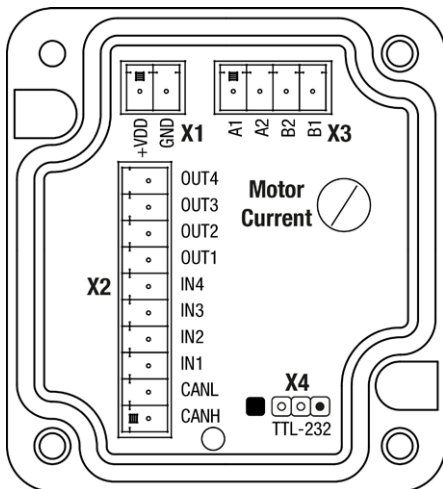
For programming and PC connection the USB connection cable VK-16 (Art. No. 0091-0010) and a PC with installed Windows operating system are mandatory.
For Mini-PLC connection please use the 3-way X4 terminal.

6.5 First steps in miCon-L

Establish the PC connection using the VK-16 connection cable and run miConL. For choosing the correct virtual COM-Port please click the right button (configure serial interface) located on the main menu page and confirm the added virtual COM-Port used by the STG-700.
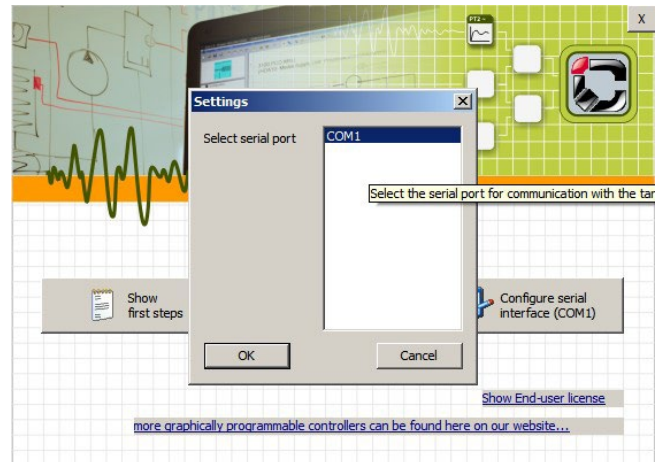
Now start miConL with creating a new project (Project-> New) or open a miCon-L sample application (Project->Open).
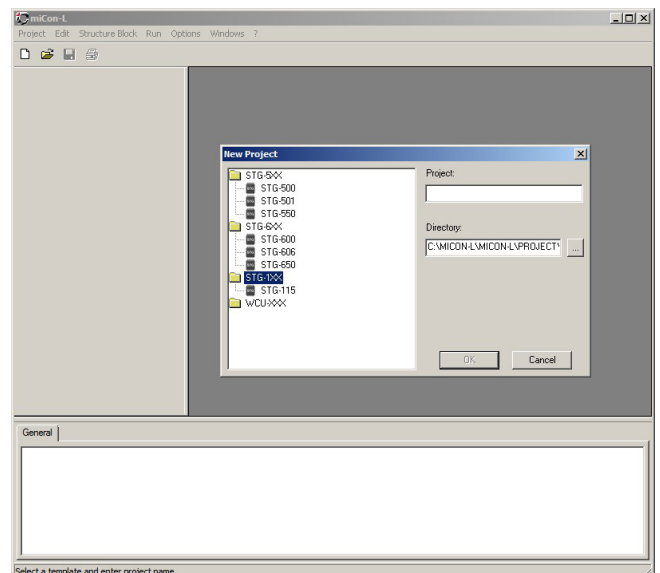
Creating a new project the desired Mini-PLC model and the project name have to be defined. After opening or creating a project the workspace of miConL with it´s libraries (right) is shown.
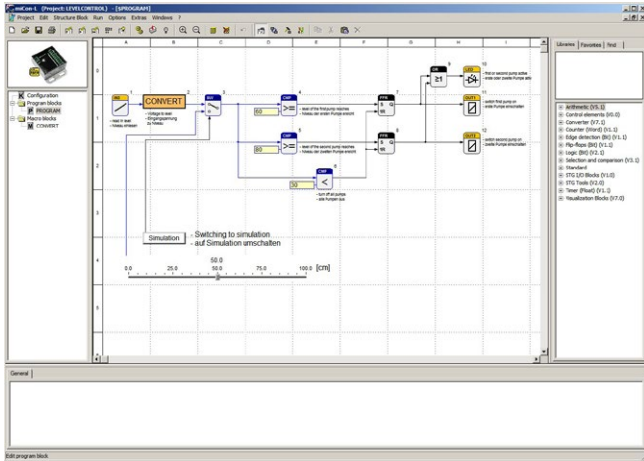
Additional help and a detailed user manual is provided within the miCon-L help and the miConL context menu (right mouse button).
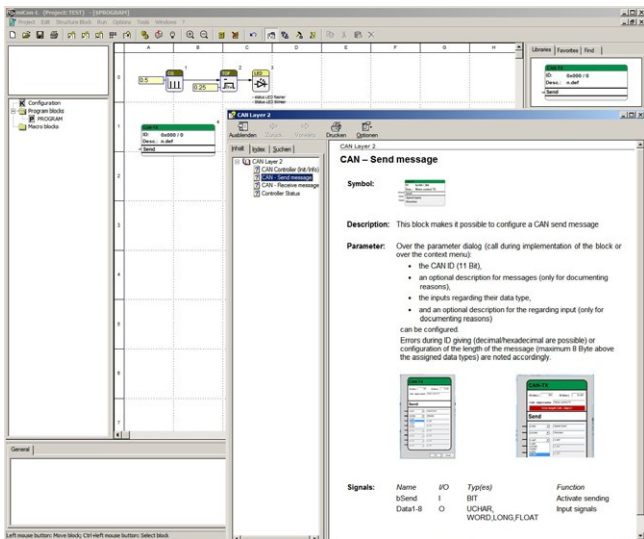
You can find sample programs in the ‚SAMPLE_PROGS‘ folder which is part of the miCon-L download package.
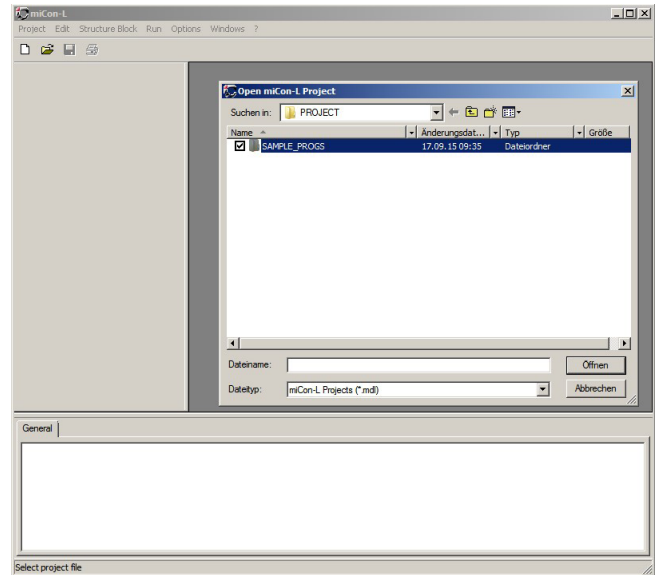
For detailed information and help please have a closer look at the documents related to the miCon-L Software Suite:

http://www.micon-l.de

7 APPENDIX

7.1 Specifications

7.1.1 General

Hardware design	BARTH® Mini-PLC fully enclosed in proprietary PU resin, tiny and rugged housing with plugable spring terminal connectors, ultra-lightweight
Programming	miCon-L Software, graphical (function block style), simulation, MODBUS programming and visualisation, free license
Interfaces	TTL-232 (5V TTL level) USB (VK-16 required) reserved for miCon-L software communication CAN 2.0A/B

7.1.2 Power supply

Operating voltage	8 to 32 VDC
Current consumption	5.6 A max.
Fusing	6 A max. (external) mandatory for voltage reversal protection
Voltage reversal protection	yes (combined with external fuse)
ESD/TVS protection	yes

7.1.3 Inputs

Number digital	4+6
Number analog	6
Digital input IN3 - IN4	$U_{IN} = 0..30$ VDC $R_{IN} > 30$ kOhm $U_{LOW} <= 2$ VDC $U_{HIGH} > =4$VDC $f_{IN} <= 1$ kHz $t_{IN} >= 1$ ms
Analog input IN1 - IN2	$U_{IN} = 0..10$ VDC $R_{IN} > 11$ kOhm $f_{IN} <= 100$Hz $t_{IN} >= 10$ ms
Accuracy ADC IN1 - IN6	± 1% (<0.2 VDC)
ADC resolution (internal)	12 Bit
Potential isolation	no (common GND)
ESD/TVS protection	yes
Permissible cable lenght (per input)	normally 40 m

7.1.4 Outputs

Number digital	4+1
Number stepper output	1
Output OUT1 - OUT4	Output type: solid state (highside) $I_{OUT} <= 1.5$ A (resistive load) @ $f_{OUT} = 0$ to 100 Hz $U_{OUT} >= U_{IN}-0,45$ V $I_{TOT} <= 4$ A (paralleling permissible) Maximal allowable load inductance for a single switch off (one output): $V_{DD}=12$VDC, $I_L=1.5$A, $Z_L<=70$mH $V_{DD}=12$VDC, $I_L=1$A, $Z_L<=200$mH On-state resistance V_{DD} to OUT: $R_{ON}<=180$ mOhm Turn-on time: $t_{ON}<=250$ µs Turn-off time: $t_{OFF}<=270$ µs
Stepper motor output	Motor Type: bipolar Motor Current: 0,1..1,5 A (adjust.) Step Modes: 1/1, 1/2, 1/4, 1/8

7.1.5 CAN interface

CAN	CAN 2.0A: 11 bit ID, base frame format CAN 2.0B: 29 bit ID, extended frame format Baud rate: 100, 125, 250, 500 kbit Meets or exceeds the requirements of applications ISO 11898-2, loss of ground protection from –27 V to 40 V, thermal shutdown protection. No termination resistor integrated.

7.1.6 Security features

Security Features	Watchdog (WD) Fail safe oscillator 16 MHz (FSO) Brown out detection (BOD) Power up timer (PUT)

7.1.7 Program and data memory

Flash program memory	64 k cell endurance: 10.000 min characteristic retention: 40 yrs
EEPROM data memory	1024 byte byte endurance 100.000 min. characteristic retention: 40 yrs

7.1.8 Timebase (oscillator)

Primary Oscillator	Crystal quartz MEMS unit (precise ,micro-electro-mechanical system‘)
Nominal Frequency	16.000 MHz
Frequency tolerance	$\pm 50 \times 10^{-6}$
Frequency aging	$\pm 5 \times 10^{-6}$ / year max.
Second Fail Safe Oscillator	16 MHz

7.1.9 Electrical connection

Electrical Connection	plugable screw-type terminal connectors 0.25 to 1.5 mm² Manufacturer: Phoenix Contact Type: MC1,5/x-ST-3,5

7.1.10 Electromagnetic compatibility (EMC)

Electrostatic discharge (ESD) on IN1 to IN4	20 kV air discharge 30 kV contact discharge (IEC/EN 61 000-4-2, level 3)
Electrostatic discharge (ESD) on OUT1 to OUT4	8 kV (human body model) (MIL-STD883D)
Electromagnetic fields	Field strength 10 V/m (IEC/EN 61000-4-3)

7.1.11 Environmental conditions

Operation temperature	-40..+50 °C (IEC 60068-2-1/2)
Storage temperature	-40..+70 °C (IEC 60068-2-1/2)
Relative humidity	5 to 95% non-condensing (IEC 60068-2-30)
Air pressure (in operation)	500 to 1500 hPa
Shock resistance	min. 100 m/s² (IEC 60068-2-27)
Vibration resistance	min. 50 m/s² @ 10..150 Hz (IEC 60068-2-6)
Degree of protection	IP 66 (EN 50178, IEC 60529)
Drop	Drop height: 500mm (IEC 60068-2-31)
Free fall (packaged)	1500 mm (IEC 60068-2-32)

7.1.12 Weight and dimensions

Weight	180 g
Dimensions	58 x 64 x 34 mm (LxWxH)
Mounting	via two M4 screws

7.1.13 Ordering information

Ordering information Mini-PLC	Mini-PLC STG-700 Art. No. 0850-0700 GTIN 4251329400132
Ordering information accessory	USB connection cable VK-16 Art. No. 0091-0016 GTIN 4251329400187

7.2 Documents, videos and software

Detailed information, additional documents, application notes and videos relating to this product are downloadable from www.barth-elektronik.de and www.micon-l.de

7.3 Disposal

If you wish to finally dispose of the product, ask your local recycling centre or dealer for details about how to do this in accordance with the applicable disposal regulations.

7.4 Conformity declaration

For the following designated product it is hereby confirmed, that the construction in that technical design brought by us in traffic corresponds to the standards specified below. In the event of any alternation which has not been approved by us being made to any device as designated below, this statement shall thereby be made invalid.

Description	Mini-PLC
Type	STG-700
Art. No.	0850-0700
Directive 2004/108/EG relating to electromagnetic compatibility (EMC) CE	Applied norms: 2004/108/EG 2004/108/EC 2014/30/EU
RoHS Directive 2011/65EU	We herby declare that our product is compilant to the RoHS Directive on restriction of the use of certain hazardous substances in electrical and electronic appliances.

BARTH® Elektronik GmbH

Lengerich, 03.08.2016

Dipl.-Ing. (FH) D. Barth
Managing Director