

lococube®
mini-PLC STG-850

MANUAL

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SAFETY INSTRUCTIONS

To ensure your own and other people's safety, as well as protect the product/s and any connected equipment, please follow the safety instructions in this manual!

These instructions are highlighted in the manual by symbols that are marked according to the level of danger and type of instruction:



Unqualified personnel must not install and work on the product/s mentioned in this manual or any other products connected to the aforementioned. Please follow so called best practices and safety norms to ensure proper and safe handling of the product/s and any connected equipment.



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 follow all safety instructions!

DESTINATED USE

The lococube® is designed for universal measuring, controlling and regulating applications.

DISCLAIMER

BARTH® assumes no liability for usage and functionality of the lococube® in case of disregarding this manual. The strict compliance with this manual is vital, since installation methods, peripheral connections, usage and maintenance can not be controlled by BARTH®. Therefore BARTH® assumes no liability for any claim.

EYE SAFETY INFORMATION

Only for products with IrDA interface (STG-810/820/850):

Standard	Classification
IEC/EN 60825-1 (2007-03), DIN EN 60825-1 (2008-05) "SAFETY OF LASER PRODUCTS - Part 1: equipment classification and requirements", simplified method	Class 1
IEC 62471 (2006), CIE S009 (2002) „Photo-biological Safety of Lamps and Lamp Systems“	Exempt
DIRECTIVE 2006/25/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5th April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual directive within the meaning of article 16(1) of directive 89/391/EEC)	Exempt

1 Product Features

- Tiny and Super-Flat CAN Logic Controller
- High-Performance 32 Bit ARM® Cortex®
- 6 analog Inputs 0 to 30 VDC, 12 bit ADC
- 4 Digital Inputs
- Event Counter Input 25 kHz
- Pulse and Frequency Counter Input 40µs
- 8 Solid State Power Outputs up to 1.5 A
- 1 Power PWM Output 16 Bit 1 Hz to 1 kHz
- CAN 2.0A/B and SAE J1939 Interface
- CANopen® Interface
- IrDA/SIR Interface
- TTL-232 3.3V Interface
- Comprehensive Fail Safe Functions
- Open Source ,C‘ Programming
- Compatible with PG-65 Programmer
- Wide Operating Voltage Range 7 to 32 VDC
- Wide Operating Temp. Range -40 to +70°C
- Vibration Resistant and Rugged Sealing
- CE, UKCA, UL und ECE-R10 Certified
- Engineered and Manufactured in Germany

2 Get Started

2.1 Mounting



The lococube® is intended to be mounted in enclosed environments, that afford protection against fire hazards, environmental conditions and mechanical impact.

1



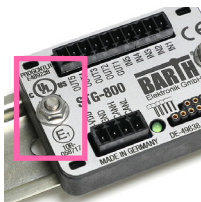
Screw mounting

Easily fasten your lococube® with two screws.

You need

Two screws M4 or selftapping screws 3.9mm.

2



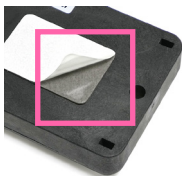
DIN Rail mounting

Fasten your lococube® in a cabinet housing.

You need

[HA-18](#)

3



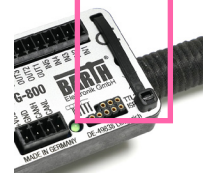
Self-adhesive pad mounting

Quickly fasten your lococube® on a plain surface.

You need

Self-adhesive tape

4



Cable tie mounting

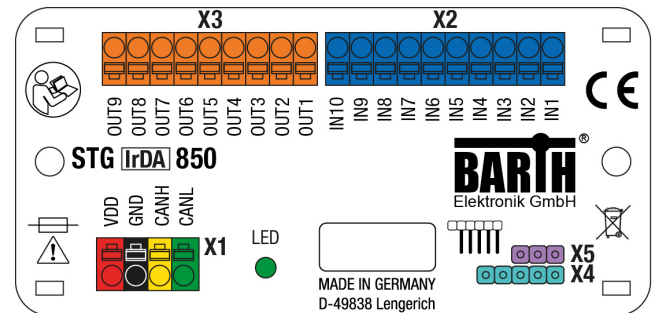
Quickly fasten your lococube® on a wiring harness or tube.

You need

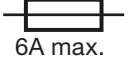

Two 3.6mm cable ties

2.2 Wiring

2.2.1 Overview



X1 Connector: Supply and CAN Pins

1	+	VDD	positive supply terminal (fused!)	
2		GND	ground terminal	
3		CANH	CAN High	
4		CANL	CAN Low	

add termination resistor 2x120R

X2 Connector: Inputs

1		IN1	Input 0-30VDC	Analog/digital
2		IN2		
3		IN3		
4		IN4		
5		IN5		
6		IN6	Input	Counter/digital
7		IN7		
8		IN8		
9		IN9	Input	Digital
10		IN10		

X3 Connector: Outputs

1		OUT1	Output digital	highside 1.5A
2		OUT2		
3		OUT3		
4		OUT4		
5		OUT5		
6		OUT6		
7		OUT7		
8		OUT8		
9		OUT9		lowside/PWM 2A

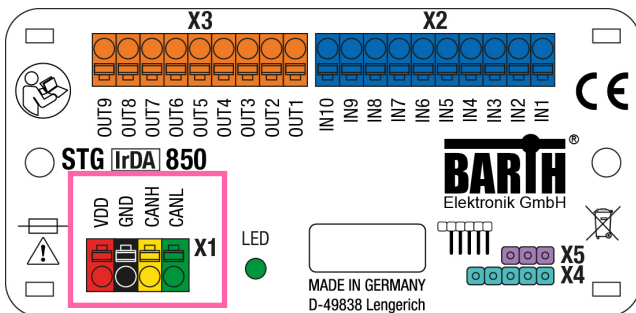
X4 Connector: Open Source ISP (via VK-46)

1	+3V3	Positive power supply (Pin 1)
2	GND	Ground terminal
3	SYS_SWDIO	System data IO
4	SYS_SWCLK	System clock
5	SYS_RESETN	System reset (inverted)

X5 Connector: TTL232 Interface (via VK-16 or VK-46)

1	GND	Ground terminal
2	TX	3V3 TTL TX terminal
3	RX	3V3 TTL RX terminal

2.2.2 Connecting the Power Supply



The lococube® features a wide supply voltage range from 7 to 32 VDC at the lowest current consumption. The lococube® 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!



Wrong electrical connection, voltage reversal or disregarding the electrical specifications may cause irreversible damage to the lococube®!

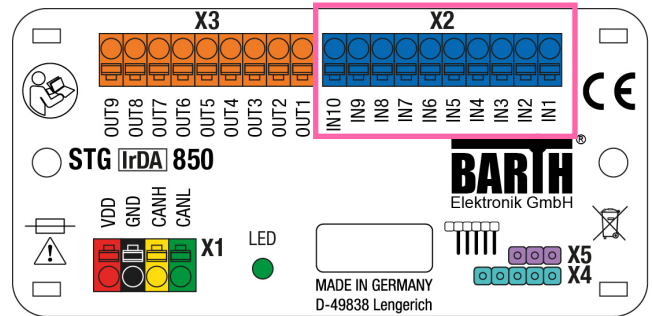
Connect the supply voltage of 7 to 32 VDC to the 4-pole terminal X1 of the lococube®. Wire the positive supply to the ‚+VDD‘ marked connection. The negative (ground) will be wired to the ‚GND‘ connection. All terminals are led out as plugable spring terminal connectors for a wire gauge of 0.25 to 1.5mm².



Ensure correct power supply voltage and polarisation!
External fusing of 6A max. is mandatory!
Disregarding may cause irreversible damage of the lococube®!

2.2.3 Connecting the Inputs

You can connect sensors, switches or buttons to the inputs of your lococube®. The sensors may be temperature, flow, pressure, photoelectric sensors or proximity switches, for example.



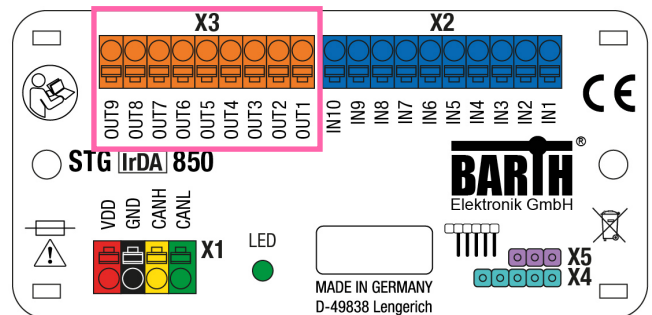
Due to the pull-down resistors integrated in the lococube® any switch (NO/NC) can simply be connected between the positive supply (VDD) and the desired input. The 10-pole connector named X2 contains the inputs of the lococube®. While IN7 to IN10 are pure digital inputs, IN1 to IN6 provide both digital or analog (0-30V) functionality. The voltage range for all inputs may not exceed 32 VDC.



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

2.2.4 Connecting the Outputs

Depending on load type and current, the lococube® is able to drive electric loads directly without any additional driver or protection circuit. The lococube® provides 8 digital solid state highside outputs and 1 solid-state lowside switch.



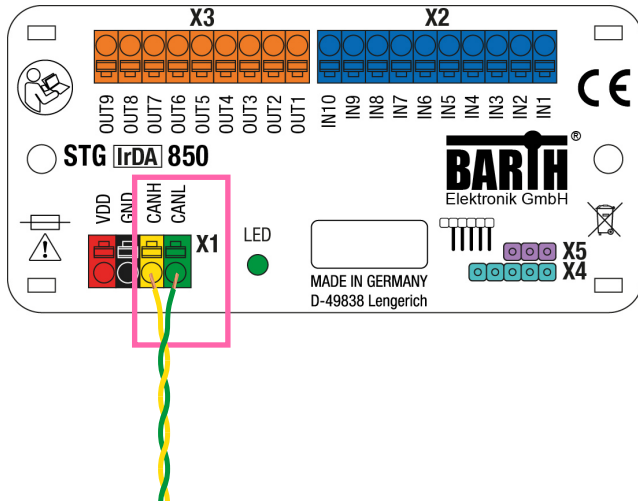
The 9-pole connector X3 contains the digital outputs of the lococube®. While OUT1 to OUT8 are overload protected highside switches, OUT9 is carried out as lowside switch with PWM capability without short circuit protection. A logical HIGH within miCon-L will switch the lococube®s supply voltage at OUT1 to OUT8, while OUT9 switches lowside (GND).



The total current sourced by OUT1 to OUT8 must not exceed 6 A! Avoid reverse voltage at any output higher than the lococube®'s supply voltage! OUT9 provides NO short circuit protection. Ensure that the sink current doesn't exceed 2 A! Negligence may cause irreversible damage to the lococube®! If you use open source programming, do not set the frequency of OUT1 to OUT8 higher than 100Hz! Rise and fall times of the output driver IC will cause higher power losses resulting in heat dissipation.

2.2.5 Connecting the CAN Interface

The X1 connector of the lococube® contains the CAN-specific pins ,CANH' and ,CANL'.



There is no termination resistor built into the lococube®. Please add a 120R resistor at both ends (2) for correct CAN bus termination.



The voltage at CANH or CANL must not exceed -32 or +32 VDC referred to ground (GND). Higher voltages may cause irreversible damage of the lococube®!

3 Get Running

3.1 Programming Software

There are two options to program your lococube®:

1



Graphical Programming

Fast, easy, and intuitive programming using function blocks.

Ideal for

Beginners and projects with shortest possible time-to-market.

You need

[mini-PLC STG-850](#)
[Connection Cable VK-16](#)
OR
[Connection Cable VK-46](#)

Software

[miCon-L IDE](#)

2



C Programming

Structured C within KEIL µVision or STM32CubeIDE.

Ideal for

Experts with the goal to realize complex and time-critical applications.

You need

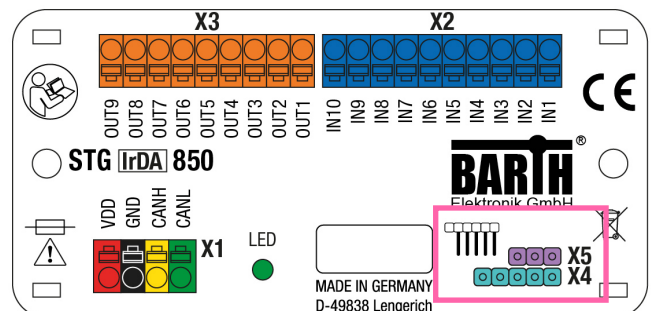
[mini-PLC STG-850](#)
[Connection Cable VK-46](#)

Software

[KEIL µVision](#)
[STM32CubeIDE](#)

3.2 Programming Interface

Connectors X4 and X5 are for programming the lococube®. For graphical miCon-L programming the X5 connector is reserved for application communication with the Connection Cable VK-16 (BARTH® Art. No. 0091-0016) or VK-46 (BARTH® Art. No. 0091-0046).



If you want to program the lococube® open source, use the X4 connector for programming and debugging with a Connection Cable VK-46 (BARTH® Art. No. 0091-0046). In this case, the X5 connector can be used as TTL232 UART interface within your application.

3.3 IrDA Interface

The STG-850 features an IrDA (SIR) interface which is based on infrared light technology to transfer serial data. This interface can be used in combination with the BARTH® PG-65 Parameter programmer (BARTH® Art. No. 0017-0065) to communicate user-defined parameters.



The IrDA Interface will not be supported using the graphical programming with miCon-L.

4 Get Support



In-depth product support is available on:
<https://support.barth-elektronik.com>

5 Appendix

5.1 Specifications

5.1.1 General

Hardware design	BARTH® lococube® mini-PLC, fully enclosed in proprietary PU resin, tiny and rugged housing with plugable spring terminal connectors, ultra-lightweight
Programming options	Graphical miCon-L, Open source ‚C‘ programming
Interfaces	UART TTL232 (3.3V TTL level) USB (VK-16 or VK-46 required) reserved for miCon-L software communication or USB/COM In-system programming (ISP) USB (VK-46 required)
	CAN 2.0 A/B
	IrDA/SIR (for PG-65 comm.)

5.1.2 Power Supply

Operating voltage	7 to 32 VDC
Current consumption	Nominal 10 mA at 32 VDC (depending on configuration)
Fusing	6 A max. (external) mandatory for voltage reversal protection
Voltage reversal protection	yes (combined with external fuse)
ESD/TVS protection	yes, integrated
Heat dissipation air (at full load)	normally < 2 W

5.1.3 Inputs

Number digital	6 + 4
Number analog	6
Analog / digital input IN1 - IN6	$U_{IN} = 0$ to 30 VDC $R_{IN} > 11$ kOhm $f_{IN} \leq 1$ kHz $t_{IN} \geq 1$ ms
Digital / counter input IN7 - IN10	$U_{IN} = 0..30$ VDC $R_{IN} > 20$ kOhm $U_{LOW} < 3$ VDC $U_{HIGH} \geq 5$ VDC $f_{IN} \leq 25$ kHz $t_{IN} \geq 40$ µs
Accuracy ADC IN1 - IN6	<0.15 VDC
ADC resolution (internal)	12 Bit
Potential isolation	no (common GND)
ESD/TVS protection	yes

5.1.4 Outputs

Number digital	8 + 1
Number PWM	1
Output OUT1 - OUT8	Output type: solid state (highside) $I_{OUT} \leq 1.5$ A (resistive load) @ $f_{OUT} = 0$ to 100 Hz $U_{OUT} \geq U_{IN} - 0.45$ V $I_{TOT} \leq 6$ A (parallel permissible) Maximal allowable load inductance for a single switch off (one output): $V_{DD} = 12$ VDC, $I_L = 1.5$ A, $Z_L \leq 70$ mH $V_{DD} = 12$ VDC, $I_L = 1$ A, $Z_L \leq 200$ mH On-state resistance V_{DD} to OUT: $R_{ON} \leq 180$ mOhm Turn-on time: $t_{ON} \leq 250$ µs Turn-off time: $t_{OFF} \leq 270$ µs
PWM Output OUT9	Output type: solid state (lowside) $I_{OUT} \leq 2$ A (resistive load) @ $f_{OUT} = 1$ Hz to 1 kHz $I_{OUT} \leq 1$ A (resistive load)
Potential isolation	no

5.1.5 Interfaces

CAN	CAN 2.0A/B: 11/29 bit ID, base frame format Baud rates: 50, 100, 125, 250, 500 kbit, 1Mbit Meets or exceeds the requirements of applications ISO 11898-2, loss of ground protection from -32 V to +32 V, thermal shutdown protection
TTL232	3.3V TTL level, config: 8N1 Baud rates: 2400 to 115.2 kbit/s
IrDA (infrared)	SIR (9.6 kbit/s to 115.2 kbit/s) IrPHY (for PG-65 communication)

5.1.6 Security Features

Security Features	System and independent watchdog Fail safe oscillator Power on/down reset Supply voltage supervisor
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5.1.7 Program and Data Memory

Memory	Flash program memory: 256 kB SRAM: 32 kB EEPROM: 8kB, >1M write cycles
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Timebase (Oscillator)

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

5.1.8 Electrical Connection

Electrical Connection	Plugable spring terminal connectors 0.25 to 1.5 mm ² Manufacturer: Phoenix Contact Series: COMBICON Type: FMC1,5/x-ST-3,5-BK
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5.1.9 Electromagnetic Compatibility (EMC)

Electrostatic discharge (ESD) on IN1 to IN10	20 kV air discharge 30 kV contact discharge (IEC/EN 61 000-4-2, level 3)
Electrostatic discharge (ESD) on OUT1 to OUT9	8 kV (human body model) (MIL-STD883D)
Electromagnetic fields	Field strength 10 V/m (IEC/EN 61000-4-3)
CAN bus terminals (CANH, CANL to GND)	IEC 61000-4-2: Unpowered Contact Discharge ± 15000 V
	IEC 61000-4-2: Powered Contact Discharge ± 8000 V

5.1.10 Environmental Conditions


Operation temperature	-40 to +70 °C (IEC 60068-2-1/2)
Storage temperature	-40 to +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. 300 m/s ² (IEC 60068-2-27)
Vibration resistance	Min. 80 m/s ² @ 10..100 Hz (IEC 60068-2-6)
Degree of protection	IP 20 (not evaluated by UL) (EN 50178, IEC 60529)
Drop	Drop height: 1000 mm (IEC 60068-2-31)
Free fall (packaged)	1500 mm (IEC 60068-2-32)

5.1.11 Weight and Dimensions





Weight	80 g (without connectors)
Dimensions	93 x 45 x 15 mm (LxWxH) Height housing: 11 mm
Mounting	Via two M4 screws or 3.6mm cable ties

5.1.12 MTTF and MTTFd

Calculation basis	DIN EN ISO 13849-1:2008 (@T=25°C)
Calculation formula	DIN EN ISO 13849-1:2008 Annex C.5: MTTF, MTTFd data of electrical components (typical and worst case) D.1: Parts count method (worst case with safety factor 10) $MTTF = \frac{1}{\sum_{i=1}^n \frac{1}{MTTF_n}}$ $MTTFd = MTTF \cdot 2$ $MTTFd = \frac{MTTF \cdot 2}{10}$ (worst case)
MTTF [years]	195
MTTFd [years]	390
MTTFd worst case [years]	39
Explanation	This information is given without any guarantee. The indicated product is no safety component according to the machine directive 2006/42/EC (subject to modifications).

	lococube® mini-PLC STG-850	MANUAL	Page: 7/7 Document: 9021-0025-D Date: 03.04.2025 Revision: D
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5.1.13 Certifications & Approvals

	2004/108/EG 2004/108/EC 2014/30/EU
	File No. E489238 UL 61010-1, 3rd Edition, May 11, 2012, Revised April 29 2016, CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition, Revision dated April 2016 File No. E489238 UL 61010-2-201 Ed.1 January 24, 2014, Revision dated February 20, 2017 CAN/CSA C22.2 No. 61010-2-201:14 Ed.1, February 2014
	CANopen® Vendor ID: 46Ah
	Cert. No. E1-10R-058717 ECE R 10, Rev. 5 (for nominal 12V automotive applications)

5.1.14 Ordering Information



Ordering information mini-PLC	lococube® mini-PLC STG-850 Art. No. 0850-0850 GTIN 4251329401443
Ordering information accessory	Connection Cable VK-16 (graphical programming) Art. No. 0091-0016 GTIN 4251329400187
	Connection Cable VK-46 (graphical & open source programming) Art. No. 0091-0046 GTIN 4251329406226
	Wiring Harness KS-85 Art. No. 0036-0085 GTIN 4251329406165

5.2 Disposal

	If you wish to dispose of the product, ask your local recycling centre or dealer about applicable disposal regulations.
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5.3 Conformity Declaration

For the following product, it is hereby confirmed that the construction and technical design corresponds to the standards specified below. In the event of any modifications which have not been approved by us to the product stated below, this statement shall thereby be made invalid.

Description	lococube® mini-PLC
Type / Art. No.	STG-850
Directive CE 2004/108/EG relating to electromagnetic compatibility (EMC) 	Applied norms: 2004/108/EG 2004/108/EC 2014/30/EU
RoHS Directive 2011/65EU	We hereby declare that our product is compliant to the RoHS directive on restriction of the use of certain hazardous substances in electrical and electronic appliances.
	BARTH Elektronik GmbH declares conformity of the product for which this manual is intended with the UKCA equivalents of the aforementioned CE regulations. We therefore deem the product to be in full compliance with UKCA regulations and take full legal responsibility for it. This declaration was issued on 30.11.2021

BARTH® Elektronik GmbH
Lengerich, 03.04.2025



Dipl.-Ing. (FH) D. Barth, CEO