Triac control systems

ST-83x / ST-84x

CONDUCTIX wampfler

Triac control systems – the proven technology

LJU

Triac control systems, such as the LJU ST-560 and ST-580 vehicle control systems, defined a new state of the art for controlling electric monorail systems in the 1980s and 1990s. They allowed overhead monorail suspension gear with different speed levels to be moved, accelerated in a defined manner, braked and positioned. The robust technology has proven itself over decades through high availability and still represents a cost-effective alternative for simple plant concepts all the way to high-performance control systems with frequency converters.

Many existing plants that are decades old continue to be operated at high operating times by means of control systems. Spare parts are increasingly difficult to obtain. Many of the original suppliers of Triac control systems have either shifted their market focus, do not support the technology any more or no longer exist.

Since the corresponding systems still fulfil their purpose and function smoothly, the Triac control systems of the ST83x and ST84x series have been redeveloped and brought up to the current state of the art. The new controls provide not only the basic capability of compensating for failures but also the possibility of completely equipping existing plants with new control systems and thus minimising the risk of failure of plants that are operated with control systems, many of which have been in continuous use for more than 20 years. The availability of the plants can thus continue to be guaranteed. The capabilities of the ST83x and ST84x control systems cover both the replacement of earlier Triac control systems (in the sense of system refurbishment) and scenarios where third-party control systems have to be substituted because they are no longer available. The current Triac control systems of the ST83x and ST84x series therefore provide options for the continued operation of plants that would have had to be decommissioned at an early stage due to the original control suppliers turning away from this control concept. Conductix-Wampfler does not endorse the departure from the TRIAC control concept. We see ourselves as a full-service provider and partner to our customers, and their economic success is important to us.

Given the increasing probability of failure, as well as the potential accumulation of failures with increasing operating time, plant refurbishments are undoubtedly a valid option for efficiently maintaining availability. This can prevent high costs due to system failures: both direct, due to difficult-to-find and expensive replacements, and indirect, due to the resulting production downtimes.

Even newly planned straightforward system concepts benefit from the robust, efficient and simple Triac control concept of the ST83x and ST84x series.

Triac control systems – in a new look

In the compact Triac control systems, the proven Triac motor controller has been carried over, brought up to the current state of the art and combined with modern, functional design.

Conductix-Wampfler vehicle control systems type ST-83x/ST-84x of the LJU “Series 8” control systems are compact, programmable Triac control systems intended for driving a single motion axis. These control systems are designed for the operation and control of pole-changing asynchronous motors in industrial and commercial plants. Typically, this concerns 8/2-pole motors, but they can also be used with 12/2 or 8/4-pole motors.

The control systems are designed using a standardised pin assignment scheme. If existing systems are to be retrofitted with other pin assignments, it is possible to meet these specific requirements by adapting the wiring on the end of the control system.

Function description

Control via travel commands

Triac control systems of the ST83x and ST84x series constantly evaluate the incoming travel commands from the system controller (e.g. via control rail) and determine the travel behaviour of the transport suspension system by linking it to the current parameter setting of the control system.

In this way, different signals in different areas of the system can be used to achieve the desired travel behaviour (e.g. slow positioning speed, high transport speed, brake release, etc.).

The separate motor windings of the travel drives are controlled via Triacs. The brake is controlled by means of an IGBT. The drive motor is driven as long as the control system detects a valid signal and no stop command is received. External sensors connected to the control systems are monitored and evaluated independently by the control systems. The necessary configuration is programmable. If a stop command is detected, the control system brings the vehicle to a complete stop. After the stop command is cancelled, the control system starts up again according to the set delay time.

Regenerative braking

To decelerate a vehicle slowly, bring it to a controlled stop and to spare the brakes, the control systems offer the option of regenerative braking (also known as pulse braking). With regenerative braking, it is possible to slowly decelerate the vehicle using the torque of the motor, in a similar way to an inverter braking ramp. The final braking is only carried out by the mechanical brake when the motor operating point of the higher-pole (slower) winding is undershot. Regenerative braking by the control system is adjustable. Application software and operating parameters can be transmitted to the control system via infra-red by means of the manual programming device (MU- 705, separately available).

Status display

The control systems continuously monitor the basic conditions of the vehicle and, in the event of a fault, issue a differentiated message via the integrated display and, if used, a collective fault message is sent to the higher-level system controller via the signal rail.

The control systems are equipped with a display that allows easy and clear reading of the status messages or error states. A list of the relevant message codes is provided on the control systems directly next to the display. This enables direct attribution as well as quick identification and reaction.

Remote control

For functions such as manual movement of a vehicle, the control systems can be addressed by means of an infra-red hand-held remote control.

Assigning parameters to the control system

Defined data records can be transferred to the control system using the MU-705 manual programming device.

These data records consist of:

- Vehicle parameters and configuration switches
- PCM configuration tables
- Vehicle tables

Vehicle parameters and configuration switches

The vehicle parameters and configuration switches are used to set the vehicle behaviour according to the system requirements. Various additional control system functions can be activated, deactivated and set.
Positive values from 0 to a maximum 65535 can be set as parameter values. The value range is limited further for some parameters.
Configuration switches are a part of the vehicle parameters. They activate or deactivate individual control system functions.

Vehicle tables

Vehicle tables contain data, which is accessed by certain control system functions. This data is assigned to the system in which the vehicle control system is used. The vehicle tables are used to set values that affect the motion and positioning functions.

PCM configuration tables

In the PCM command system, different half-wave patterns are transmitted to the vehicle control system via the PCM hardware. The vehicle control system is able to recognise these commands and adjust its behaviour accordingly. The PCM configuration table defines how the vehicle control system behaves with a PCM command.

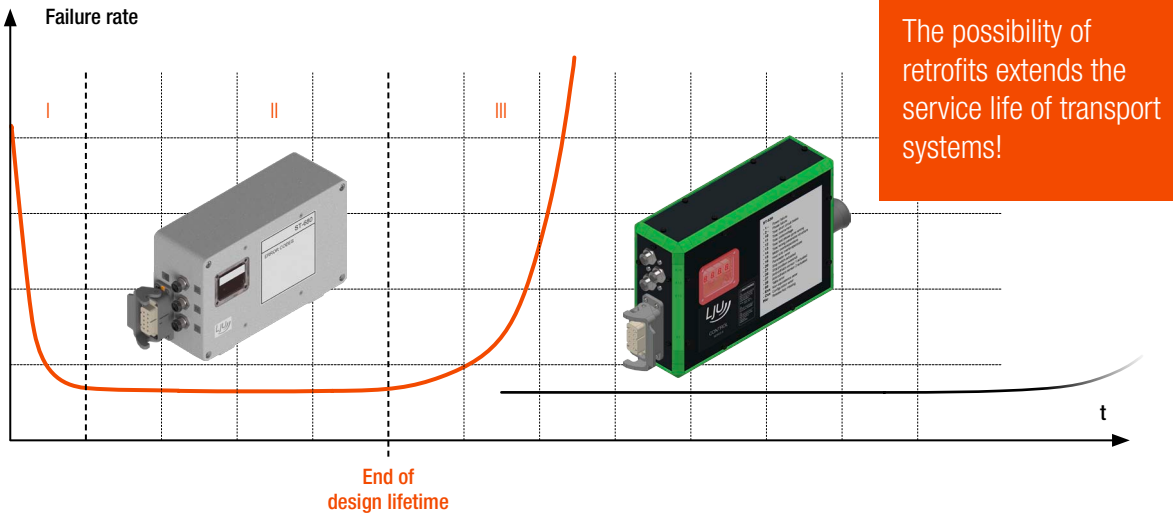
Retrofits – replacing Triac control systems proactively

Triac control systems

Triac control systems date back to the 1980s and early 1990s and were the most advanced technology at that time for automating conveyor solutions and allowing vehicles to travel at different speeds. Today, this basic automation can of course be implemented with current inverter control systems. However, these have a much wider range of functions and are therefore more expensive. The focus on inverter control systems consequently means that there is very little need for new equipment in the segment of Triac control systems. Many of the original manufacturers are either no longer active **in the market**, have re-oriented their line of business or no longer support the Triac control system technology. Moreover, essential components of the original control systems are no longer procurable on the market. Generally speaking, many systems with Triac control systems are still in operation and it is becoming increasingly difficult to maintain these systems or even expand them if necessary due to the difficult procurement situation.

Support and service for old Triac systems

In general, it is also possible to install inverter control systems as replacements in existing systems or use them for system expansions. However, it must be acknowledged that although it is possible to achieve functional compatibility, there are significant differences in the installation elements, fixing points, connector types, handling, parametrisation and administration. In some cases, very complex adaptations will therefore be required. These aspects must be considered just as much as the effects and additional costs that may be incurred from mixed operation of old Triac control systems and current inverter control systems.



The possibility of retrofits extends the service life of transport systems!

Conductix-Wampfler – your partner for control systems

In our efforts to be a long-term and trustworthy partner for our customers, we have decided to launch a **new generation of Triac control systems** so that we can offer relevant devices when there is a need for spare parts, repairs or system conversions and expansions. In this way, we are actively contributing to the continued operation of the conveyor technology, ensuring that procurement and maintenance costs are kept low.

Now that the Triac control systems are available again, and are functionally compatible with the predecessor control systems and many similar control systems, it is much easier to maintain systems with Triac control systems, regardless of brand.

A look at typical failure and error probabilities of control systems in conveyor systems reveals what is known as the “bathtub curve”. Increased risks of failure are to be expected at the beginning and end of the product life cycle. The initial risks at the beginning can be countered by final tests, burn-ins and commissioning/production support. The failures towards the end of the life cycle are increasingly generated by ageing components, wear and tear. As a rule, this can only be counteracted by intensive maintenance and proactive replacement of the affected components. This certainly comes at a cost, but the reduced probability of failure, the use of new electronics and the resulting improved availability quickly compensates for the profitability of such an investment.

Control and command systems

Control via half waves and full waves

With half-wave control, 3 different commands can be transmitted to the carriage controller by means of half waves and full waves. The commands for this are transmitted from the system controller to the control input S1 via a busbar isolated from the supply voltage.

Control (commands) via the busbar	
Half wave +	Control command 1
Half wave -	Control command 2
Full wave	Control command 3
Control inputs S1	230 V / 400 V AC half waves

Receives 3 commands

3 status messages from the control system can also be transmitted from the error message output M to the system controller via half waves or full waves and a separate busbar.

Messages via the signal rail	
Half wave +	Presence message (default)
Half wave -	Error message (default)
Full wave	Message 3
Error message output M	Relay contact 230 V (L3) max. 0.5 A

Sends 3 messages

Control via pulse code modulation (PCM) command system

The PCM command system is an extension of the half-wave controller. It enables a large number of commands to be transmitted via a control rail. Command coding is used where the commands are transmitted as a combination of mains voltage half-waves in a mains-synchronous manner.

In the PCM command system, up to 191 different half-wave patterns are transmitted as commands to the carriage controller via a control rail by means of the LJU system hardware, which is connected to the higher-level system controller.

Control (commands) via the control rail	
PCM	Control command 0 ... 191
Control inputs S1	230 V / 400 V AC PCM

Receives max. 192 commands

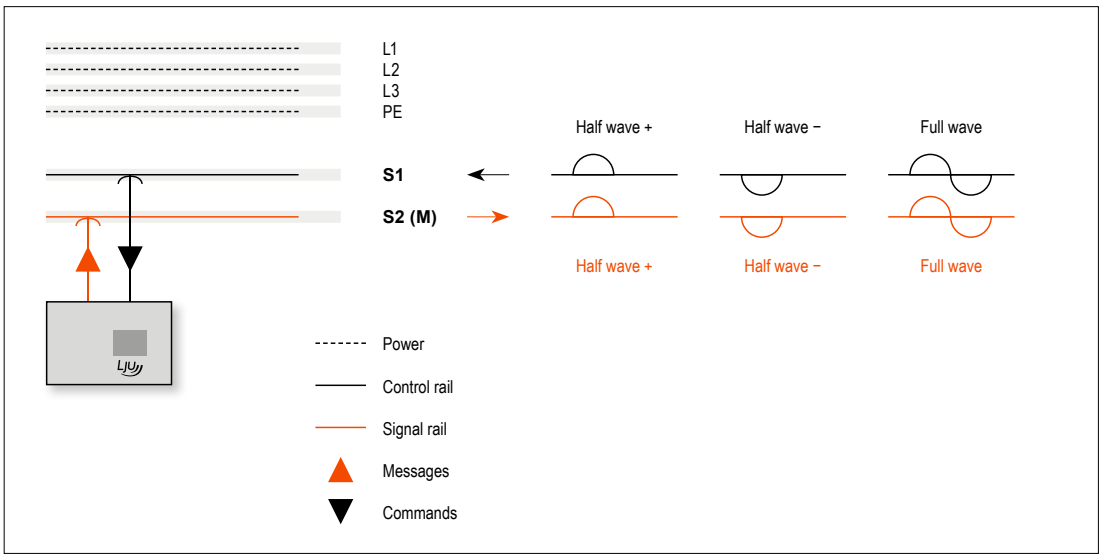
Status messages directed at the system controller are transmitted from the carriages as half and full waves via a separate signal rail.

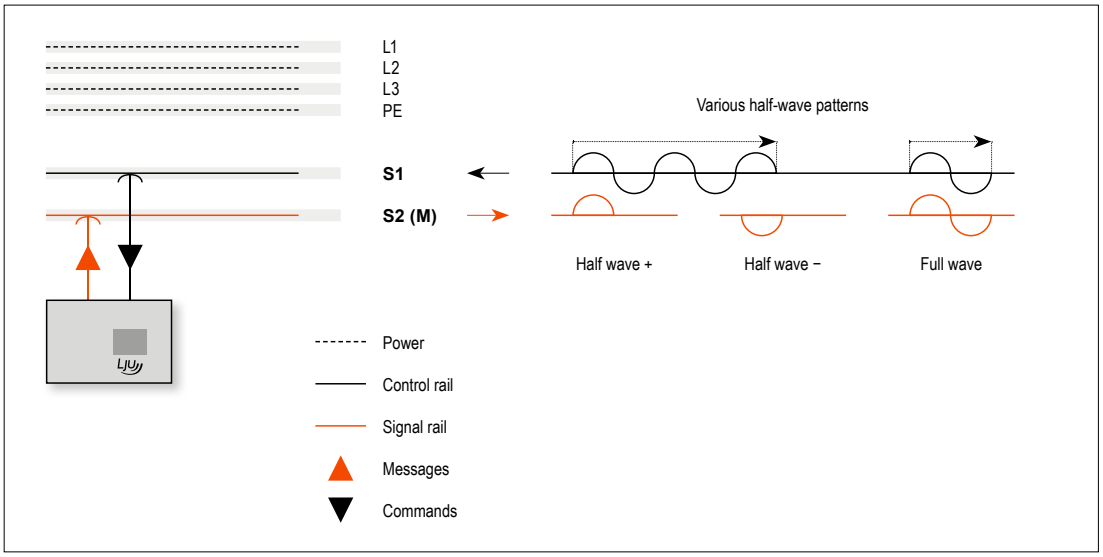
Messages via the signal rail	
Half wave +	Presence message (default)
Half wave -	Error message (default)
Full wave	Message 3
Error message output M	Relay contact 230 V (L3) max. 0.5 A

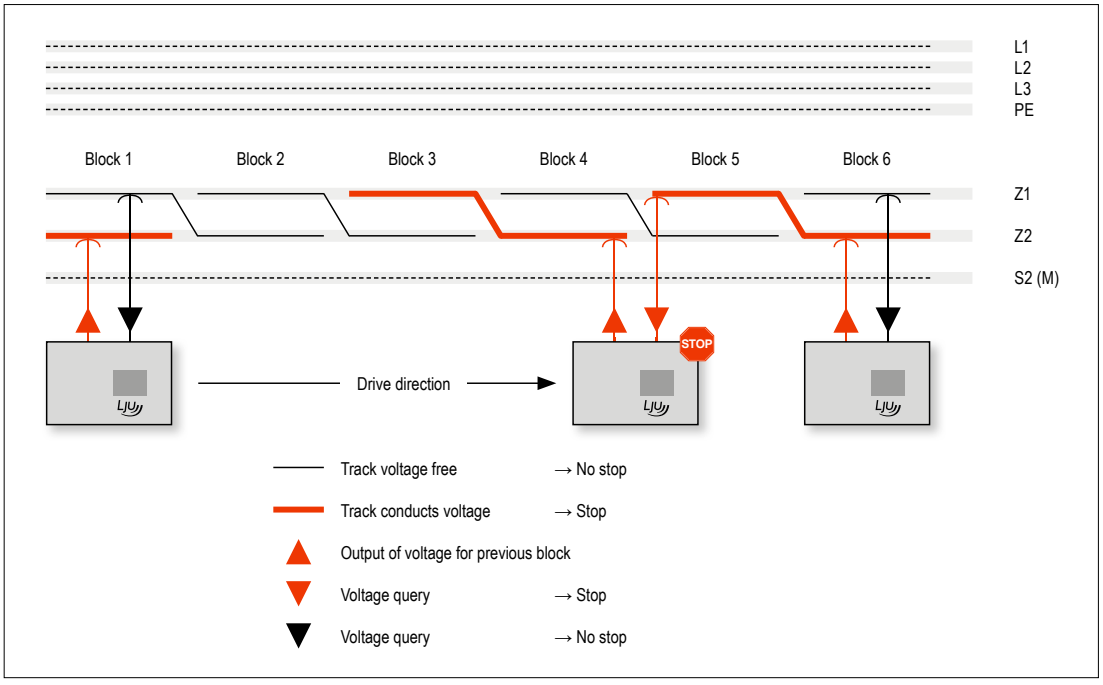
Sends 3 messages

Z-stop control

A simple way to control the carriages is through the Z-stop. The control system is operated via control rails Z1 and Z2, which are connected in a “Z-shape”. The carriages are stopped and protected against collision through voltage sensing. The stop command for a carriage is given by the presence of voltage in individual block sections, which is applied to the rail by the carriage travelling ahead or by the system controller in order to stop vehicles.


L1
L2
L3
PE
S1
S2 (M)
Half wave +
Half wave −
Full wave
Half wave +
Half wave −
Full wave
Power
Control rail
Signal rail
Messages
Commands


L1
L2
L3
PE
Various half-wave patterns
S1
S2 (M)
Half wave +
Half wave −
Full wave
Power
Control rail
Signal rail
Messages
Commands

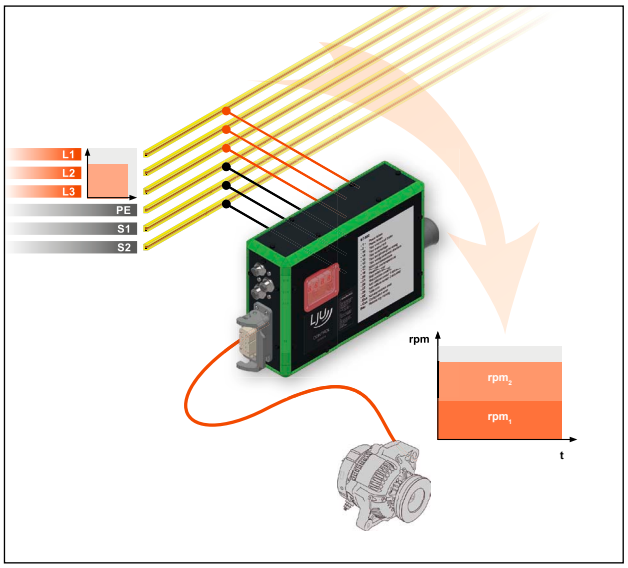

L1
L2
L3
PE
Block 1
Block 2
Block 3
Block 4
Block 5
Block 6
Z1
Z2
S2 (M)
STOP
Drive direction
Track voltage free
→ No stop
Track conducts voltage
→ Stop
Output of voltage for previous block
Voltage query
→ Stop
Voltage query
→ No stop

Variants and controllable motors

Triac control systems of the types ST-83x are designed for a 3-phase grid feed at 50 Hz, mostly via conductor rail systems. With the ST-84x type, a 3-phase feed from an **external frequency converter** is used as the supply, whereby conductor rails are typically used as the transmission medium to the moving consumers. Moreover, a separate, external 230/400 VAC supply is required in this case for the internal switching power supply and motor brakes.

In principle, both variants are suitable for controlling pole-changing asynchronous motors. Unless specified or provided for by the design of the systems, the ST-830 and ST-832 are the preferred choice.

Conventional connection



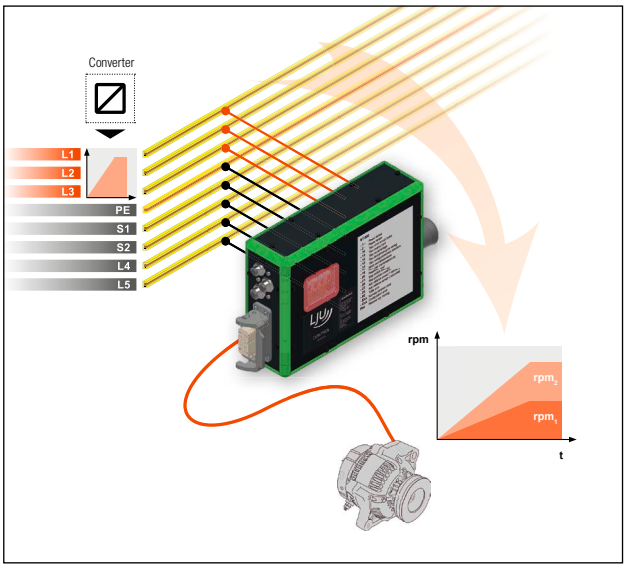
3-phase grid feed

- 2 fixed speeds (revolutions/min)

ST-830

ST-832

Connection with upstream inverter



3-phase feed from an external frequency converter

- Variable revolutions / 2 ranges

ST-842

Power classes

Type	
ST-830	Power class 0 Rated motor power up to 0.75 kW
ST-832 ST-842	Power class 2 Rated motor power up to 2.0 kW

Sensors

External sensors connected to the control system are monitored and evaluated continuously and independently by the control system. The system-specific configuration of the control system can be programmed for this purpose.

Among other things, it is possible to connect, monitor and control the following external devices:

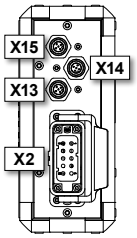
- Magnetic switches
- Limit switches
- Positioning initiators
- Emergency OFF switches
- Indicator lamps

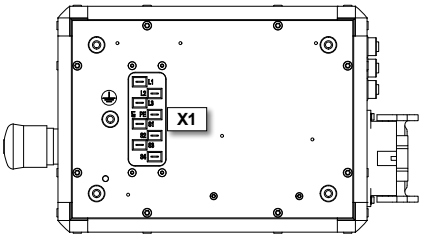
Temperature monitoring

The control system can record and evaluate the motor temperature via the motor connection.

Standardised electrical connections

X1	Supply/communication
X2	Motor
X13	Sensors/actuators
X14	
X15	





X1	X2	X13 / X14 / X15
Faston 6.3 mm / 8-pin	Harting HAN10A	M12 socket 5-pin, A-coded
- Grid feed - PE Communication: - Commands: PCM, HW - Messages: HW - Z-stop	- Motor winding 1 - Motor winding 1/2 - Motor winding 2 - Brake - Motor temperature sensor	- 24 V DC Supply OUT - 24 V DC Digital IN

Accessories

Remote control

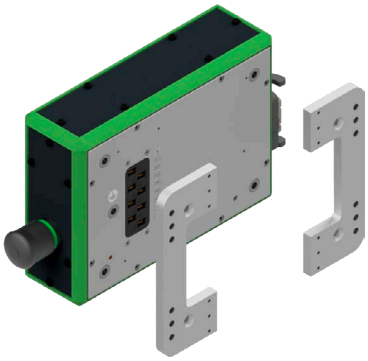
The FB-8 remote control is used is used for manual control of vehicle control systems. Both the remote control and the vehicle control systems are equipped with the corresponding software and have an infra-red and/or Bluetooth interface.

Manual programming device

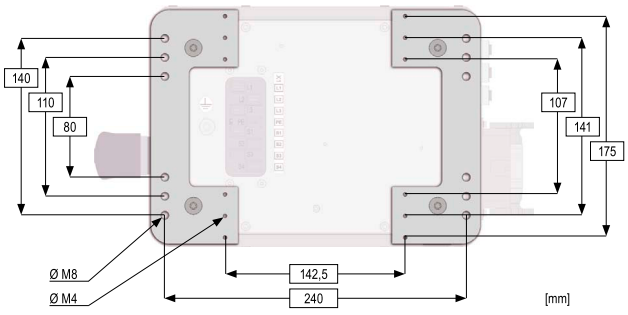
The MU-705 is used for manual control, parametrisation and programming of vehicle control systems.
Data transmission between the MU-705 and the control system takes place via infra-red and is therefore backwards compatible with control systems of the 6xx and 7xx series with corresponding software as well as with all control systems of the latest 8xx generation.
The manual programming device was primarily developed for parametrisation and updating of vehicle control systems. It also has other features including vehicle information retrieval, manual control of vehicles and much more.

Furthermore, it is possible to back up data and modify parametrisation data by connecting the MU-705 to a computer with the MU-705 Utility Software installed.

Assembly adapter



Adapter pieces for assembly of the control system on fixing points of old LJU control systems. Consequently, no conversion measures are necessary. Different positions can be achieved by rearranging the fixing points in multiple ways.



Technical data

Device

Power classes	
ST-830	Power class 0 – rated motor power up to 0.75 kW
ST-832 ST-842	Power class 2 – rated motor power up to 2.0 kW

Size and weight	
Dimensions: W × H × D (mm)	260 × 190 × 81
Weight	3.0 kg

Ambient conditions	
Climatic environmental conditions according to DIN IEC 60721-3-3	Category: 3K3 (fixed-location usage*; weatherproof)
Mechanical environmental condition according to DIN IEC 60721-3-3	Category: 3M4 (fixed-location usage*; weatherproof)
Ambient temperature without non-condensing derating, no dew formation	+10 … +45 °C The control system is thermally inherently safe. If the temperature is too high, the system is shut down and an error message is issued.
Ambient temperature with derating	+45 … +60 °C – 5 %/K
Maximum installation height without derating	1000 m (above mean sea level)
Relative humidity	< 80% non-condensing
Storage temperature	-10 … +50 °C
Protection category	I
Protection class	IP54 – except for connection X1 (Faston on rear of device)
EMC conformity (interference suppression)	Complies with EN IEC 61000-6-2

* The use in conjunction with a rail system is considered fixed use. The rail system must be designed so that the control system is not subjected to impermissible impacts.

Input data

Power supply			
	ST-830	ST-832	ST-842
Supply type	3-phase AC connection TT or TN mains with directly earthed star point		3-phase alternating current from external frequency converter with sine filter
Rated input voltage	3 × AC 380 … 440 V		3 × AC 0 … 440 V
Rated input frequency	50/60 Hz (± 5 %)		not specified
Short-circuit current (SCCR)	5 kA	5 kA	5 kA
Max. power consumption (standby)	2 W	2 W	2 W
Power loss (typical) Self-heating in still air by 35 K	approx. 5 W	approx. 12 W	approx. 12 W

Technical data

Separate power supply			
	ST-830	ST-832	ST-842
Input voltage range	Not used		AC 220 … 440 V (± 10 %)
Current consumption (typical)	Not used		max. 15 W
Input frequency	Not used		50 / 60 Hz (± 5 %)

Half-wave/PCM input			
	ST-830	ST-832	ST-842
Input voltage range* According to hardware configuration	AC 220 … 277 V (± 10 %) AC 380 … 440 V (± 10 %)		
Current consumption (typical)	3 mA		
Input frequency synchronous to the grid	50 / 60 Hz (± 5 %)		
* Measured against the reference phase of the inputs.			

Z-stop input			
	ST-830	ST-832	ST-842
Input voltage range*	AC 380 … 440 V (± 10 %)		Not used
Current consumption (typical)	3 mA		
Input frequency synchronous to the grid	50 / 60 Hz (± 5 %)		
* Measured against the reference phase of the inputs.			

Digital inputs			
	ST-830	ST-832	ST-842
Current consumption at 24 V	1.2 mA ±10 %		
High level	+20 … +30 V DC		
Low level	0 … +8 V DC		

Output data

Axis data			
	ST-830	ST-832	ST-842
Power class	0	2	
Rated motor power	0.75 kW	2.0 kW	
Rated output current	3.0 A	5.0 A	
Device maximum currents (5s)	16 A		
Operating mode as per IEC 60034-1	S9		
Output voltage	3 × AC U_{In}		
Output frequency	f_{IN}		
Motor protection	PTC/bi-metal		
Maximum brake stop current	DC 0.44 A		
Brake control output voltage	DC 0.45 × UIN		DC 0.45 × U_{In} *
* Depending on input voltage for separate power supply of the switching power supply unit			

Signal output			
	ST-830	ST-832	ST-842
Relay contact	Max. permitted voltage: 277 V Max. permitted load current 25 mA at 85°C (limited by PTC)		
Integrated short-circuit protection	Yes		
Max. ohmic load	10 kΩ		

Digital outputs			
	ST-830	ST-832	ST-842
Model	Short-circuit-proof		
Rated output current	For each output: max. DC 0.25 A / Total: max. DC 0.5 A		
Inductive loads	Yes		
High level	24 V DC (± 5 %) / RON = 200 mΩ		
Low level	< 1 V DC		

Display with infra-red interface

Display	7-segment LED, 4-digit
Infra-red angle of incidence	± 16º
Infra-red transmission range	1 m
Infra-red type	IRDA standard
Infra-red transmission rate	62.5 kbit/s
Infra-red transmission mode	bi-directional, half-duplex

Cable lengths and specifications

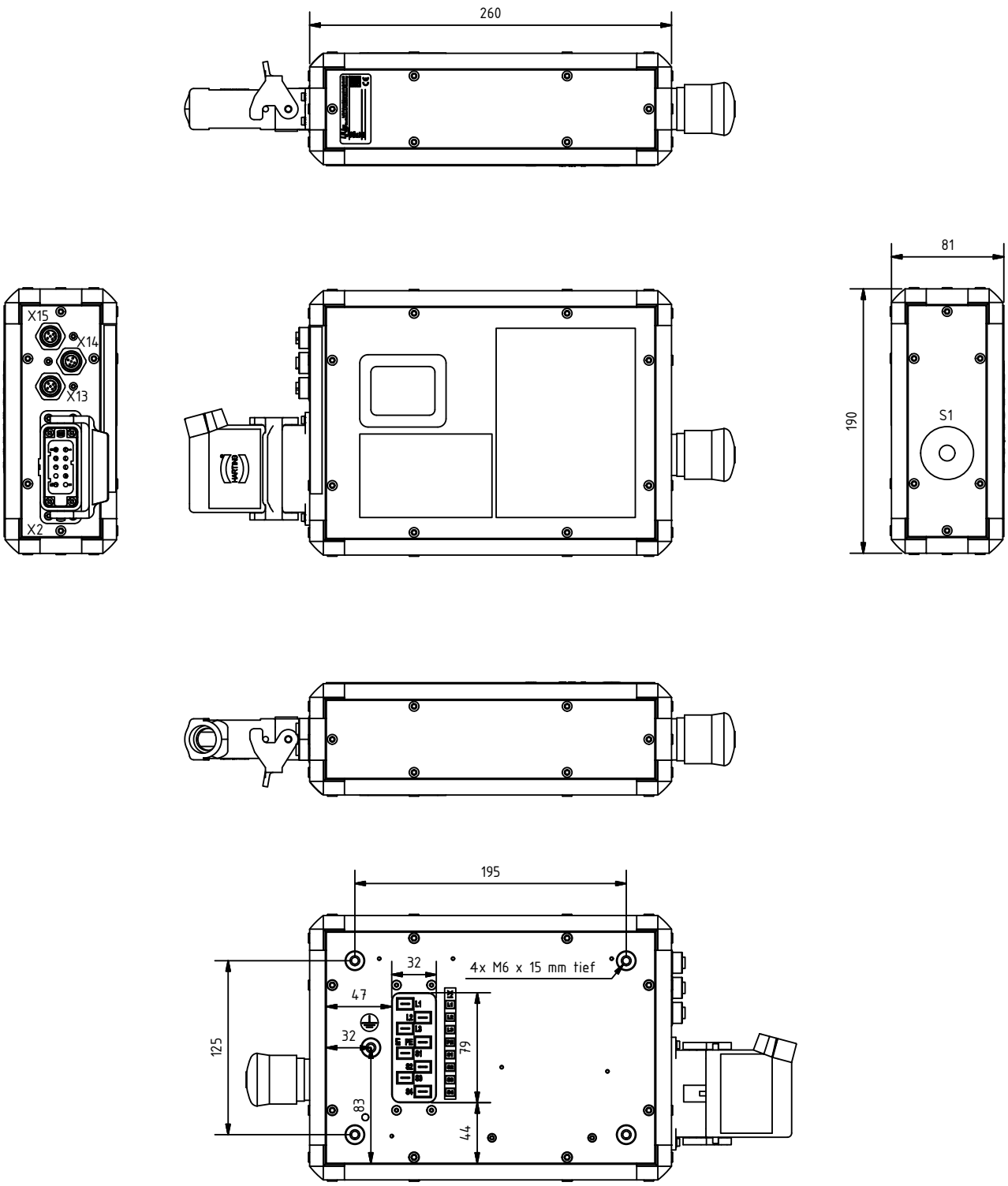
	Cable length *	Specification *
Between control system and overhead monorail rail, L1, L2, L3, PE	≤ 2 m	≥ 2.5 mm^2
Between control system and overhead monorail rail, S1, S2, S3, S4	≤ 2 m	≥ 2.5 mm^2
Between control system and sensors	≤ 5 m	≥ 0.35 mm^2
Vehicle PE		≥ 2.5 mm^2 At least like the wire cross section of L1, L2, L3

* recommendation

Conformity

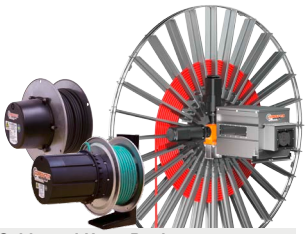
Devices made by LJU Automatisierungstechnik GmbH have been designed to comply with EU directives.

Technical data



Your Applications – our Solutions

The solutions we deliver for your applications are based on your specific requirements. In many cases, a combination of several different Conductix-Wampfler systems can prove advantageous. You can count on Conductix-Wampfler for hands-on engineering support together with the optimum solution to safely meet your needs.

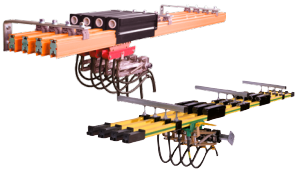


Cable and Hose Reels

Motor driven and spring driven reels by Conductix-Wampfler provide energy, data and media over a variety of distances, in all directions, fast and safe.

Festoon Systems

Conductix-Wampfler cable trolleys can be used in virtually every industrial application. They are reliable, robust and available in an enormous variety of dimensions and designs.



Conductor Rails

Available as enclosed or multiple unipole systems, Conductix-Wampfler conductor rails reliably move people and material.

Inductive Power Transfer IPT®

The no-contact system for transferring energy and data. For all tasks that depend on high speeds and absolute resistance to wear. Flexible installation when used with Automated Guided Vehicles.

Non-insulated Conductor Rails

Robust, non-insulated aluminum conductor rails with stainless steel cap provide the ideal basis for power supply of people movers and transit networks.

Radio Remote Controls

Safety remote control solutions customized to meet our customer needs with modern ergonomic design.

Reels, Retractors and Balancers

Available for hoses and cables, as classical reels or high-precision positioning aids for tools, we offer a complete range of reels and spring balancers.

Jib Booms

Complete with tool transporters, reels or an entire media supply system – safety and flexibility are key to the completion of difficult tasks.

Slip Ring Assemblies

Whenever things are really “moving in circles”, the proven slip ring assemblies by Conductix-Wampfler ensure the flawless transfer of energy and data. Here, everything revolves around flexibility and reliability!

Mobile Control Systems

Mobile control solutions for your plant – wether straightforward or intricate. Control and communication systems from LJU have been tried and tested in the automotive industry for decades.

ProfiDAT

This data transfer system is a compact slotted waveguide and furthermore can be used as Grounding rail (PE) as well as positioning rail at the same time.

www.conductix.com

Conductix-Wampfler
has just one critical mission:
To provide you with energy and data transmission systems that will keep your operations up and running 24/7/365.

To contact your nearest sales office, please refer to:
www.conductix.contact

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