COMBIVERT

G6

Programming manual
Control unit

COMBIVERT G6
IO Link

Translation of the original manual		
Document	Part	Version
20100117	GBR	01

KEB

Preface

The described hard- and software are developments of the KEB Automation KG. The enclosed documents correspond to conditions valid at printing. Misprint, mistakes and technical changes reserved.

Signal words and symbols

Certain operations can cause hazards during the installation, operation or thereafter. There are safety informations in the documentation in front of these operations. Security signs are located on the device or machine. A warning contains signal words which are explained in the following table:

⚠ DANGER	Dangerous situation, which will cause death or serious injury in case of non-observance of this safety instruction.
⚠ WARNING	Dangerous situation, which may cause death or serious injury in case of non-observance of this safety instruction.
⚠ CAUTION	Dangerous situation, which may cause minor injury in case of non-observance of this safety instruction.
Attention	Situation, which can cause damage to property in case of non-observance.

RESTRICTION

Is used when certain conditions must meet the validity of statements or the result is limited to a certain validity range.

Is used when the result will be better, more economic or trouble-free by following these procedures.

More symbols

►	This arrow starts an action step.
• / -	Enumerations are marked with dots or indents.
=>	Cross reference to another chapter or another page.

Note to further documentation.
https://www.keb.de/de/service/downloads.html

Laws and guidelines

KEB Automation KG confirms with the CE mark and the EC declaration of conformity, that our device complies with the essential safety requirements.

The CE mark is located on the name plate. The EC declaration of conformity can be downloaded on demand via our website. Further information is provided in chapter "Certification".

Warranty

The warranty on design, material or workmanship for the acquired device is given in the current terms and conditions.

Here you will find our current terms and conditions.
https://www.keb.de/de/agb.html

Further agreements or specifications require a written confirmation.

Support

Through multiple applications not every imaginable case has been taken into account. If you require further information or if problems occur which are not treated detailed in the documentation, you can request the necessary information via the local KEB Automation KG agency.

The use of our units in the target products is beyond of our control and therefore exclusively the responsibility of the machine manufacturer, system integrator or customer.

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the application. However, they are considered for information only without responsibility. This also applies to any violation of industrial property rights of a third-party.

Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the application by the machine manufacturer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Copyright

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Glossary

0V	Earth-potential-free common point
1ph	1-phase mains
3ph	3-phase mains
AC	AC current or voltage
ASCL	Asynchronous sensorless closed loop
AWG	American wire gauge
BiSS	Open source real-time interface for sensors and actuators (DIN 5008)
CAN	Fieldbus system
COMBIVERT	KEB drive converters
COMBIVIS	KEB start-up and parameterizing software
DC	DC current or voltage
DIN	German Institut for standardization
EMC	Electromagnetic compatibility
Emergency stop	Shutdown of a drive in emergency case (not de-energized)
Emergency switching off	Switching off the voltage supply in emergency case
Emulation	Software-generated encoder output
EN	European standard
Endat	Bidirectional encoder interface of the company Heidenhain
EtherCAT	Real-time Ethernet bus system of the company Beckhoff
FE	Functional earth
FU	Drive converter
GND	Reference potential, ground
GTR7	Braking transistor
HF filter	High frequency filter to the mains
Hiperface	Bidirectional encoder interface of the company Sick-Stegmann
HMI	Human maschine interface (touch screen)
HSP5	Fast, serial protocol
HTL	Incremental signal with an output voltage (up to 30V) -> TTL
I^2t-monitoring	Software function for thermal monitoring of the motor winding
IEC	International standard
IP xx	Degree of protection (xx for level)
KTY	Silicium temperature sensor (polarized)
MCM	American unit for large wire cross sections
Modulation	Means in drive technology that the power modules are controlled
MTTF	Mean service life to failure
NN	Sea level
OC	Overcurrent
OSSD	Output switching element; - an output signal that is checked in regular intervals on its shutdown. (safety technology)
PE	Protective earth
PELV	Protective Extra Low Voltage
PFD	Term used in the safety technology (EN 61508-1...7) for the size of error probability
PFH	Term used in the safety technology (EN 61508-1...7) for the size of error probability per hour
PLC	Programmable logic controller
Port	Part of a network address to the assignment of TCP and UDP connections
PT100	Temperature sensor with R0=100Ω
PT1000	Temperature sensor with R0=1000Ω
PTC	PTC-resistor for temperature detection
PWM	Pulse width modulation
RJ45	Modular connector with 8 lines
SCL	Synchronous sensorless closed loop
SELV	Electrically isolated low voltage (< 60 V)
SIL	The security integrity level is a measure for quantifying the risk reduction. Term used in the safety technology (EN 61508 -1..7).
SS1	Safety function „Safe stop 1“ in accordance with IEC 61800-5-2

SSI	Synchronous serial interface for encoder
STO	Safety function „Safe Torque Off“ in accordance with IEC 61800-5-2
TTL	Incremental signal with an output voltage up to 5 V
USB	Universal serial bus
VARAN	Real-time Ethernet bus system

Used standards

DGUV regulation 3	Electrical systems and equipment
DIN 46228-1	Wire-end ferrules; Tube without plastic sleeve
DIN 46228-4	Wire-end ferrules; Tube with plastic sleeve
DIN IEC 60364-5-54	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors
EN 55011	Industrial, scientific and medical equipment - Radio frequency disturbance characteristics - Limits and methods of measurement
EN 55021	Interference to mobile radiocommunications in the presence of impulse noise - Methods of judging degradation and measures to improve performance
EN 60204-1	Safety of machinery - electrical equipment of machines Part 1: General requirements (VDE 0113-1, IEC 44/709/CDV)
EN 60439-1	Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies
EN 60529	Degrees of protection provided by enclosures (IP Code) (IEC 60529)
EN 60664-1	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests (IEC 60664-1)
EN 60721-3-1	Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - section 1: Storage
EN 60721-3-2	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 2: Transport
EN 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 3: Stationary use at weatherprotected locations
EN 61000-2-1	Electromagnetic compatibility (EMC) - Part 2: Environment - Section 1: Description of the environment - Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems
EN 61000-2-4	Electromagnetic compatibility (EMC) - part 2-4: Environment; Compatibility levels in industrial plants for low-frequency conducted disturbances
EN 61000-4-2	Electromagnetic compatibility (EMC) - part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-3	Electromagnetic compatibility (EMC) - part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4	Electromagnetic compatibility (EMC) - part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5	Electromagnetic compatibility (EMC) - part 4-5: Testing and measurement techniques - Surge immunity test
EN 61000-4-6	Electromagnetic compatibility (EMC) - part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-34	Electromagnetic compatibility (EMC) - part 4-34: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase
EN 61373	Railway applications - Rolling stock equipment - Shock and vibration tests
EN 61508-1...7	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1...7 (VDE 0803-1…7, IEC 61508-1…7)
EN 61800-2	Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable frequency a.c. power

	drive systems (VDE 0160-102, IEC 61800-2)
EN 61800-3	Speed-adjustable electrical drives. Part 3: EMC requirements and specific test methods (VDE 0160-103, IEC 61800-3)
EN 61800-5-1	Electrical power drive systems with adjustable speed. Part 5-1: Requirements on the safety - electrical, thermal and energy requirements (VDE 0160-105-1)
EN 61800-5-2	Electrical power drive systems with adjustable speed. Part 5-2: Requirements on the safety – functional safety (VDE 0160-105-2, UL 61800-5-2)
EN 62061	Safety of machinery - functional safety of electrical, electronic and programmable electronic safety-related systems (VDE 0113-50, IEC 62061)
EN ISO 13849-1	Safety of machinery - safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1)
UL 61800-5-1	American version of the EN 61800-5-1 with „National Deviations“

1 Basic Safety Instructions

The COMBIVERT is designed and constructed in accordance with state-of-the-art technology and the recognised safety rules and regulations. However, the use of such devices may cause functional hazards for life and limb of the user or third parties, or damages to the system and other material property.

The following safety instructions have been created by the manufacturer for the area of electric drive technology. They can be supplemented by local, country- or application-specific safety instructions. This list is not exhaustive. Non-observance will lead to the loss of any liability claims.

Attention

Hazards and risks through ignorance.

► Read the instruction manual!

► Observe the safety and warning instructions!

► If anything is unclear, please contact KEB Automation KG!

1.1 Target group

This instruction manual is determined exclusively for electrical personnel. Electrical personnel for the purpose of this instruction manual must have the following qualifications:

- Knowledge and understanding of the safety instructions.
- Skills for installation and assembly.
- Start-up and operation of the product.
- Understanding of the function in the used machine.
- Detection of hazards and risks of the electrical drive technology.
- Knowledge of *DIN IEC 60364-5-54*.
- Knowledge of national safety regulations (e.g. *DGUV regulation 3*).

1.2 Transport, storage and proper use

The transport is carried out by qualified persons in accordance with the environmental conditions specified in this manual. Drive converter shall be protected against excessive strains.

Transport of drive converters with an edge length >75 cm

The transport by forklift without suitable tools can cause a deflection of the heat sink. This leads to premature aging or destruction of internal components.

► Transport of drive converters on suitable pallets.

► Do not stack drive converters or burden them with other heavy objects.

Drive converters contain electrostatic sensitive components.

► Avoid contact.

► Wear ESD-protective clothing.

Do not store drive converters

- in the environment of aggressive and/or conductive liquids or gases.
- with direct sunlight.
- outside the specified environmental conditions.

1.3 Installation

⚠ DANGER

Do not operate in an explosive environment!

► The COMBIVERT is not intended for the use in potentially explosive environment.

⚠ CAUTION

Maximum design edges and high weight!

Contusions and bruises!

► Never stand under suspended loads.

► Wear safety shoes.

► Secure drive converter accordingly when using lifting gear.

To prevent damages to the device:

- Make sure that no components are bent and/or isolation distances are changed.
- The device must not be put into operation in case of mechanical defects. Non-compliance with the applicable standards.
- Do not allow moisture or mist to penetrate the unit.
- Avoid dust permeating the device. Allow for sufficient heat dissipation if installed in a dust-proof housing.
- Note installation position and minimum distances to surrounding elements. Do not cover the ventilation openings.
- Mount the drive inverter according to the specified degree of protection.
- Make sure that no small parts fall into the COMBIVERT during assembly and wiring (drilling chips, screws etc.). This also applies to mechanical components, which can lose small parts during operation.
- Check the reliable fit of the device connections in order to avoid contact resistances and sparking.
- Do not walk-on drive converter.
- The safety instructions are to be kept!

1.4 Electrical connection

⚠ DANGER

Voltage at the terminals and in the device!

Danger to life due to electric shock !

- ► Never work on the open device or never touch exposed parts.
- ► For any work on the unit switch off the supply voltage and secure it against switching on.
- ► Wait until the drive has stopped in order that no regenerative energy can be generated.
- ► Await capacitor discharge time (5 minutes) if necessary, measure DC voltage at the terminals.
- ► If personal protection is required, install suitable protective devices for drive converters.
- ► Never bridge upstream protective devices (also not for test purposes).
- ► Connect the protective earth conductor to drive converter and motor.
- ► Install all required covers and protective devices for operation.
- ► The control cabinet shall be kept closed during operation.

For a trouble-free and safe operation, please pay attention to the following instructions:

- The electrical installation shall be carried out in accordance with the relevant requirements.
- Cable cross-sections and fuses must be dimensioned according to the design of the machine manufacturer. Specified minimum / maximum values may not be fallen below /exceeded.
- Drive converters are only intended for permanent connection. Cross-sections of protective earth conductors should be interpreted in accordance with *EN 61800-5-1*.
- Connection of the drive converter is only permissible on symmetrical networks with a maximum line voltage (L1, L2, L3) with respect to earth (N/PE) of max. 300 V. An isolating transformer must be used for supply networks which exceed this value. In case of non-compliance the control is not longer considered as "safe separate circuit".
- With existing or newly wired circuits the person installing the units or machines must ensure the EN requirements are met.
- For drive converters that are not isolated from the supply circuit (in accordance with *EN 61800-5-1*) all control lines must be included in other protective measures (e.g. double insulation or shielded, earthed and insulated).
- When using components without isolated inputs/outputs, it is necessary that equipotential bonding exists between the components to be connected (e.g. by the equipotential line). Disregard can cause destruction of the components by equalizing currents.

If personnel protection is required during installation of the system, suitable protective devices must be used for drive converters.
ti_rcd_0400_0002_gbr.pdf

Installations which include drive converter shall be equipped with additional control and protective devices in accordance with the relevant applicable safety requirements, e.g. act respecting technical equipment, accident prevention rules etc. They must always be complied with, also for drive converter bearing a CE marking.

1.4.1 EMC-compatible installation

Observance of the limit values required by EMC law is the responsibility of the manufacturer of the installation or machine.

Notes on EMC-compatible installation can be found here.
0000ndb0000.pdf

1.4.2 Voltage test

Testing with AC voltage (in accordance with *EN 60204-1* Chapter 18.4) may not be executed, since there is danger for the power semiconductors in the drive converter.

Because of the noise suppression capacitors the test generator will immediately trigger with current error.

Accordng to *EN 60204-1* it is permissible to disconnect already tested components. Drive converters of the KEB Automation KG are delivered ex works voltage tested to 100% according to product standard.

1.4.3 Insulation measurement

An insulation measurement (in accordance with *EN 60204-1* chapter 18.3) with DC 500 V is permissible, if all power unit connections (grid-connected potential) and all control connections are bridged with PE. At any unit it can be expected with an insulating resistance > 5 MΩ!

1.5 Start-up and operation

The drive converter must not be started until it is determined that the installation complies with the machine directive; Account is to be taken of *EN 60204-1*.

⚠ WARNING

Software protection and programming!

Hazards caused by unintentional behavior of the drive!

- ► Check especially during initial start-up or replacement of the drive converter if parameterization is compatible to application.
- ► Securing a unit solely with software-supported functions is not sufficient. It is imperative to install external protective measures (e.g. limit switch) that are independent of the drive converter.
- ► Secure motors against automatic restart.

⚠ CAUTION

High temperatures at heat sink and coolant!

Burning of the skin!

- ► Cover hot surfaces safe-to-touch.
- ► Before working let the unit cool down.
- ► Before touching, check the surface and cooling water lines.
- ► If necessary, attach warning signs on the system.

- During operation, all covers and doors shall be kept closed.
- Use only approved accessories for this device.
- Never touch terminals, busbars or cable ends.

Observe the following instructions if the drive converter for more than one year was not in operation before start-up.
ti_format_capacitors_0400_0001_gbr.pdf

Switching at the output

Switching between motor and drive converter is prohibited for single drives during operation as this may trigger the protection gear of the device. Function speed search must be activated if switching can not be avoided. Control release may only be triggered after closing the motor contactor (e.g. by switching the control release).

Connecting and disconnecting is permissible with multiple motor drives if at least 1 motor is running during the switch-over process. The drive converter must be dimensioned to the occurring starting currents.

The speed search function must be activated if the motor is still running during a restart of the drive converter (mains on) (e.g. due to large rotating masses).

Switching an the input

For applications that require cyclic switching on and off of the drive converter, maintain an off-time of at least 5 min. If you require shorter cycle times please contact KEB Automation KG.

Short-circuit proof

The drive converters are conditional short-circuit proof. After resetting the internal protection devices, the function as directed is guaranteed.

Exceptions:

- If an earth-leakage fault or short-circuit often occurs at the output, this can lead to a defect in the unit.
- If a short-circuit occurs during regenerative operation (2nd or 4th quadrant, regeneration into the DC link), this can lead to a defect in the unit.

1.6 Maintenance

The following maintenance work has to be carried out when required, but at least once per year by authorized and trained personnel.

► Check unit for loose screws and plugs and tighten if necessary.

► Clean drive converter from dirt and dust deposits. Pay attention especially to cooling fins and protective grid of the fans.

► Examine and clean extracted air filter and cooling air filter of the control cabinet.

► Check the function of the fans of the drive converter. The fan must be replaced in case of audible vibrations or squeak.

► Make a visual leak test of the cooling circuit for water-cooled inverters.

1.7 Repair

In case of malfunction, unusual noises or smells inform a person in charge!

⚠ DANGER

Unauthorized exchange, repair and modifications!

Unpredictable malfunctions!

► The function of the drive converter is dependent on its parameterization. Never replace without knowledge of the application.

► Modification or repair is permitted only by KEB Automation KG authorized personnel.

► Only use original manufacturer parts.

► Infringement will annul the liability for resulting consequences.

In case of failure, please contact the machine manufacturer. Only the machine manufacturer knows the parameterisation of the used drive converter and can provide an appropriate replacement or induce the maintenance.

1.8 Disposal

Drive converters with safety function are limited to a service life of 20 years. Then the devices must be replaced.

Drive converters of the KEB Automation KG are professional, electronic devices exclusively for further industrial processing (so-called B2B devices). Thus the marking does not occur with the symbol of the crossed-out wheeled bin, but by the word mark and the date of manufacture.

Unlike devices mainly used in private households, these devices may not be disposed at the collection centres of public sector disposal organisations. They must be disposed after the end of use in accordance with national applicable law to environmentally correct disposal of electrical and electronic equipment.

2 Product Description

The product family COMBIVERT G6 with safety function STO has been developed for the use in safety-oriented applications. The basic standards as well as application and country-specific standards must be observed furthermore. The manual refer to standards that are complementary to note!

This document is a description of the functions and parameters of the G6 - control card with IO-Link interface.

The control provides the following functions:

- IO-Link device interface
- Hardware-installed supply of digital and analog inputs and outputs.
- Diagnostic interface (parameter display, scope mode, data exchange)
- Hardware of the control circuit „safety separated“ according to *EN 61800-3* (base TN-C/-S mains)
- Inverter state LED
- optional with safety function STO (separate manual)
- optional f=0 Hz functionality (separate manual)
- Brake control
- STO functionality

2.1 Specified application

The KEB COMBIVERT serves exclusively for the control and regulation of three-phase motors. It is intended for installation in electrical systems or machines.

The technical data as well as information concerning the supply conditions shall be taken from the name plate and from the instruction manual and shall be strictly observed.

The used semiconductors and components of the KEB Automation KG are developed and dimensioned for the use in industrial products.

Limitation

If the KEB COMBIVERT G6 is used in machines, which work under exceptional conditions or if essential functions, life-supporting measures or an extraordinary safety step must be fulfilled, the necessary reliability and security must be ensured by the machine builder.

2.1.1 Residual risks

In spite of the intended use, the drive converter can reach unexpected operating conditions in error case, wrong parameterisation, incorrect connection or unauthorized interventions and repairs. This can be:

- wrong direction of rotation
- motor speed too high
- motor is running into limitation
- motor can also be under current during standstill
- automatic start-up

2.2 Improper use

The operation of other electric consumers is prohibited and can lead to the destruction of the unit. The operation of our products outside the indicated limit values of the technical data leads to the loss of any liability claims.

2.3 Type code

xx	G6	x	x	x	-	x	x	x	x

Cooling (not valid for customer-/special version)	
0	Air-cooling (housing C, E), air-cooling/flat rear (housing A, B)
1	Flat rear

Control/keyboard/display (not valid for customer-/special version)		
A	G6L-G	Open-loop without keyboard/display
B	G6L-G	Open-loop with keyboard/display
2	G6P-S	SCL (Sensorless Closed Loop) without keyboard/display
3	G6P-S	SCL (Sensorless Closed Loop) with keyboard/display
4	G6L-M	ASCL (Asynchronous Sensorless Closed Loop) without keyboard/display
5	G6L-M	ASCL (Asynchronous Sensorless Closed Loop) with keyboard/display

Switching frequency; short time current limit; overcurrent cut-off (not valid at customer/special version)			
1	4 kHz	125 %	150 %
2	8 kHz	125 %	150 %
5	4 kHz	150 %	180 %
6	8 kHz	150 %	180 %
9	4 kHz	180 %	216 %
A	8 kHz	180 %	216 %

Voltage, connection							
0	1-phase	230 V	AC/DC	3	3-phase	400 V	AC/DC
1	3-phase	230 V	AC/DC	5		400 V	DC
2	1/3-phase	230 V	AC/DC	6	1-phase	230 V	AC
A-Z	Customer-/special version (firmware and download)						

Housing type A, B, C, E

Variants					
0	without filter, without braking transistor, without safety function STO	A	like 0 with STO	H	like A with f=0Hz
1	without filter, with braking transistor, without safety function STO	B	like 1 with STO	I	like B with f=0Hz
2	internal filter; without braking transistor, without safety function STO	C	like 2 with STO	K	like C with f=0Hz
3	internal filter, with braking transistor, without safety function STO	D	like 3 with STO	L	like D with f=0Hz

continued on the next page

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Control type	
C	Analog/digital (standard)
D	CAN® [1]
E	IO-Link® [2]
F	EtherCAT® [3]
H	reserved
I	VARAN
G6 unit type	
Inverter size	

3 IO-Link Interface

An IO-Link slave (device) interface is implemented according to the IO-Link specification V1.0. Cyclic process data (PDO) and acyclic parameter data (SPDU - service protocol data unit) are supported for accessing the parameters of the device.

The device does not support the standard IO mode (SIO mode). After the wake-up is immediately switched to the communication mode.

3.1 Identification

About the direct parameter data channel with Frame Type 0 the most important information for commissioning the communication can be read at startup:

Address	Parameter Name	Access	Implementation /reference	Description
Direct Parameter page 1				
0x00	Master-Command	W	Mandatory/ see B.1.2	Master command to switch to operating states (see NOTE 1)
0x01	MasterCycle-Time	R/W	Mandatory/ see B.1.3	Actual cycle duration used by the Master to address the Device. Can be used as a parameter to monitor Process Data transfer.
0x02	MinCycleTime	R	Mandatory/ see B.1.4	Minimum cycle duration supported by a Device. This is a performance feature of the Device and depends on its technology and implementation.
0x03	M-sequence Capability	R	Mandatory/ see B.1.5	Information about implemented options related to M-sequences and physical configuration
0x04	RevisionID	R/W	Mandatory/ see B.1.6	ID of the used protocol version for implementation (shall be set to 0x11)
0x05	ProcessDataIn	R	Mandatory/ see B.1.7	Number and structure of input data (Process Data from Device to Master)
0x06	ProcessData-Out	R	Mandatory/ see B.1.8	Number and structure of output data (Process Data from Master to Device)
0x07	VendorID 1 (MSB)	R	Mandatory/ see B.1.9	Unique vendor identification (see NOTE 2)
0x08	VendorID 2 (LSB)			
0x09	DeviceID 1 (Octet 2, MSB)	R/W	Mandatory/ see B.1.10	Unique Device identification allocated by a vendor
0x0A	DeviceID 2 (Octet 1)			
0x0B	DeviceID 3 (Octet 0, LSB)			

(Accessed via addresses 0000h (16 byte) and 0001h (16 byte) via SPDU possible)

Individual values are displayed as COMBIVIS parameters:

Id-Text	Name	Parameter index
fb03	Unit identification	0x2183
Meaning	Unit identification number	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0...FFFFFFh Standard value: 0	
Note	Any combination of G6 power unit config ID and control card config ID has its own deviceID (reference table)	

Id-Text	Name	Parameter index
fb05	IO-Link baud rate	0x2185
Meaning	Baud rate IO-Link bus	
Type	Variable	
Data length	8 bit	
Access	read	
Coding	1: 4.8 kBd (COM1) 2: 38.4 kBd (COM2) 3: 230.4 kBd (COM3) Standard value: 2: 38.4 kBd	
Note	Baud rate not changeable.	

An addressing of the device is not necessary, because IO-Link connections are always 1:1 connections with the master. A master can have multiple output ports.

3.2 IO-Link status and error message

The status of the IO-Link state machine is shown in the following parameters.

Id-Text	Name	Parameter index
fb01	DLState + MasterCommand	0x2181
Meaning	Display for DLState + MasterCommand	
Type	Variable	
Data length	8 bit	
Access	read	
Coding		

Bitmask	0xFF00	Bitmask	0X00FF
Name	DL status	Name	Master command
Sub-definitions	[5]	Sub-definitions	[5]
SIO	0	Fallback	90
CommStart	256	undefined	0
CommFinished	512	DeviceStartup	151
Startup	768	PD output operate	152
Operate	1024	DeviceOperate	153

Standard value: 0

Note	-

The following parameters are to assess the quality of bus communication:

Id-Text	Name	Parameter index
fb07	Transmitter overcurrent	0x2187
Meaning	Display of overcurrent events at the transmitter	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: no overcurrent 1: Overcurrent occurred Standard value: 0	
Note	-	

3.3 Frame types

The IO-Link specification defines different telegram types, which differ by the size of the process input and process output data.

For the buildup of the communication, the master must determine the communication parameters of the device. One of the relevant informations is the length of the process data. Based on this information, the IO-Link master decides which type of telegram for cyclic data exchange is used.In the phase of the communication setup the master uses the telegram type 0.

For the cyclic communication the G6 supports the frame type 1 in the "interleaved mode":

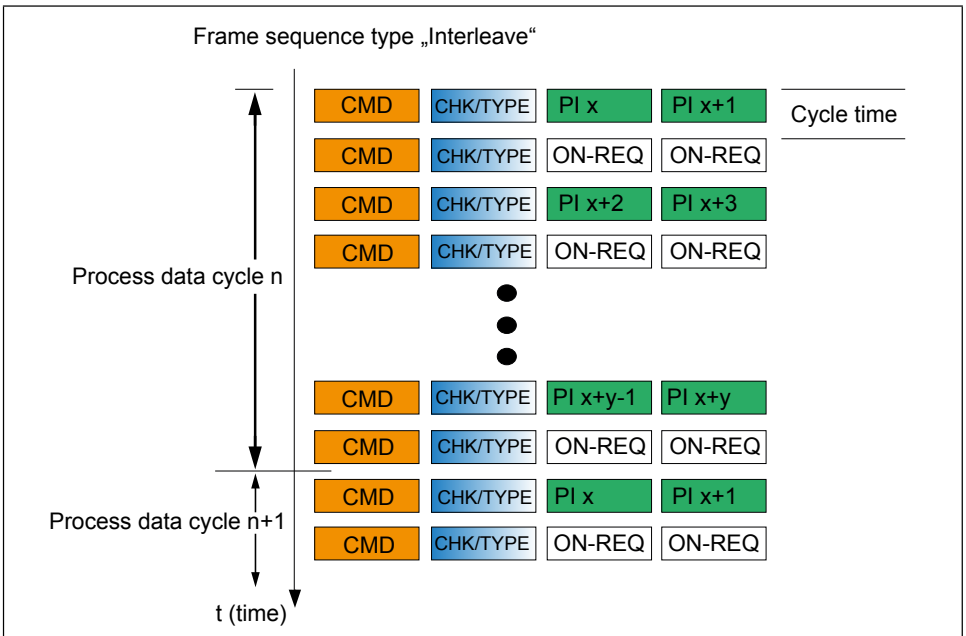


Figure 1: Interleaved mode

By that it also sent on-request data between the process data. If they are not needed, dummy commands are transmitted. Thus, a fixed process data cycle time is realized. At first the PD-out data are transmitted, after that the PD-in data.

3.4 Parameterization data (SPDU)

The device parameters can be addressed via a 16-bit index plus 8-bit sub-index. About the subindex with the values 1...n each subindices or sets of parameters can be addressed.

About the subindex 0, all subindices 1...n addressed simultaneously. If at write access a value can not be written (e.g. because it is outside the valid value range), all others are still written. The first error message from several not possible write accesses is sent to the master.

Generally written will be only the corresponding data type byte (incl. value range checks), excess bytes are ignored. Exception when writing to subindex 0. In this case the number of bytes to be written are checked. When reading the correct data length is returned.

3.5 Process data

There are each 4 bytes of process data available per direction. The number can not be changed.

For each process data object a maximum of 4 objects can be mapped.

The data direction is described from the view of the process control (PLC, IPC, ...).

Process output data (PD out) are data from the control to G6.

Process input data (PD in) are data from G6 to the control.

To activate the process data objects in the device, it is necessary to set the mapping of the process data by using the parameters defined in chapter 3.

The writing of the process output data (2 * 2 byte) and reading of process input data (2 * 2 byte) results in a cycle time of 18.4 ms.

If via the IO-Link master command (value 0x99) the output process data is set invalidated, the processing of the output process data in the power unit is stopped (PD out count is set to 0).

At switched off power unit, the last received PD in process data are sent. In addition, an event is generated, which marks the invalidity of the process data.

The number of the performed process data accesses is illustrated in the following parameters:

Id-Text	**Name**	**Parameter index**
fb02	Received PDOut	0x2182
Meaning	Number of received process output data (PD out)	
Type	Variable	
Data length	16 bit	
Access	read / write	
Coding	0...65535 Standard value: 0	
Note	-	

4 Process Data Mapping

The setting of the process data assignment is possible via the KEB-specific parameters (fb10-fb19). After successful adjustment of the process data mapping the process data can be processed by the G6 device.

After loading of the default values, a standard process data mapping is already set. The number of each mapped parameters (fb14, fb19) has to be written once (default value 2) to activate the process data. Then the numbers are stored non-volatile.

In addition, the IO-link master must release the output process data via the master command (value 0x98).

4.1 Output process data (manager => client)

Id-Text	Name	Parameter index
fb10	PD out index	0x218A
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	Default up to 4 parameter addresses to be used as process data. Only parameters may be used that are allowed as process data.	
Data length	16 bit	
Access	read / write	
Coding	0000h…7FFFh Standard value: 0000h	
Note	-	

Id-Text	Name	Parameter index
fb11	PD out subindex	0x218B
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	The value of the subindex determines the parameter set of the selected PD parameter.	
Data length	8 bit	
Access	read / write	
Coding	1...8 for subindex 1...8 (or rather set 0..7) Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
fb12	PD out offset	0x218C
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	Specifies the offset of occupancy in the process data field. Position of the value of the mapped parameter.	
Data length	8 bit	
Access	read / write	
Coding	0...3 Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
fb13	PD out type	0x218D
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	The value specifies the parameter type of the selected PD parameter.	
Data length	8 bit	
Access	read / write	
Coding	0: off (no parameter type defined) 1: Long (32bit) 2: Word (16bit) 3: Byte (8 bit) Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
fb14	PDO-out count	0x218E
Meaning	Sets the number of PD-out objects	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...4 Standard value: 0	
Note	Is automatically set to 0 when changing the parameters fb10... fb13.	

4.2 Input process data (client => manager)

Id-Text	Name	Parameter index
fb15	PD in index	0x218F
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	Default up to 8 parameter addresses to be used as process data. Only parameters may be used that are allowed as process data.	
Data length	16 bit	
Access	read / write	
Coding	0000h…7FFFh Standard value: 0000h	
Note	-	

Id-Text	Name	Parameter index
fb16	PD in subindex	0x2190
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...8		
Meaning	The value of the subindex determines the parameter set of the selected PD parameter.	
Data length	8 bit	
Access	read / write	
Coding	1...8 for subindex 1...8 (or rather set 0..7) Standard value: 1	
Note	-	

Id-Text	Name	Parameter index
fb17	PD in offset	0x2191
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	Specifies the offset of occupancy in the process data field. Position of the value of the mapped parameter.	
Data length	8 bit	
Access	read / write	
Coding	0...3 Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
fb18	PD in type	0x2192
Type	Array	
Subindex 0		
Meaning	Number of subindices of this object	
Data length	8 bit	
Access	read	
Coding	4 Standard value: 4	
Note	-	
Subindex 1...4		
Meaning	The value specifies the parameter type of the selected PD parameter.	
Data length	8 bit	
Access	read / write	
Coding	0: off (no parameter type defined) 1: Long (32bit) 2: Word (16bit) 3: Byte (8 bit) Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
fb19	PDO in count	0x2193
Meaning	Sets the number of PD in objects	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...4 Standard value: 0	
Note	Is automatically set to 0 when changing the parameters fb15... fb18.	

5 Description file (IODD)

Combivis 6 allows the creation of IO-link device descriptions (IODDs) for the G6 devices with IO-Link interface. The IODDs comply with the specification of version 1.0.1.

For this purpose, the process data mapping is set at the startup wizard. After that use the button "device description" to start the IO-Link IODD export:

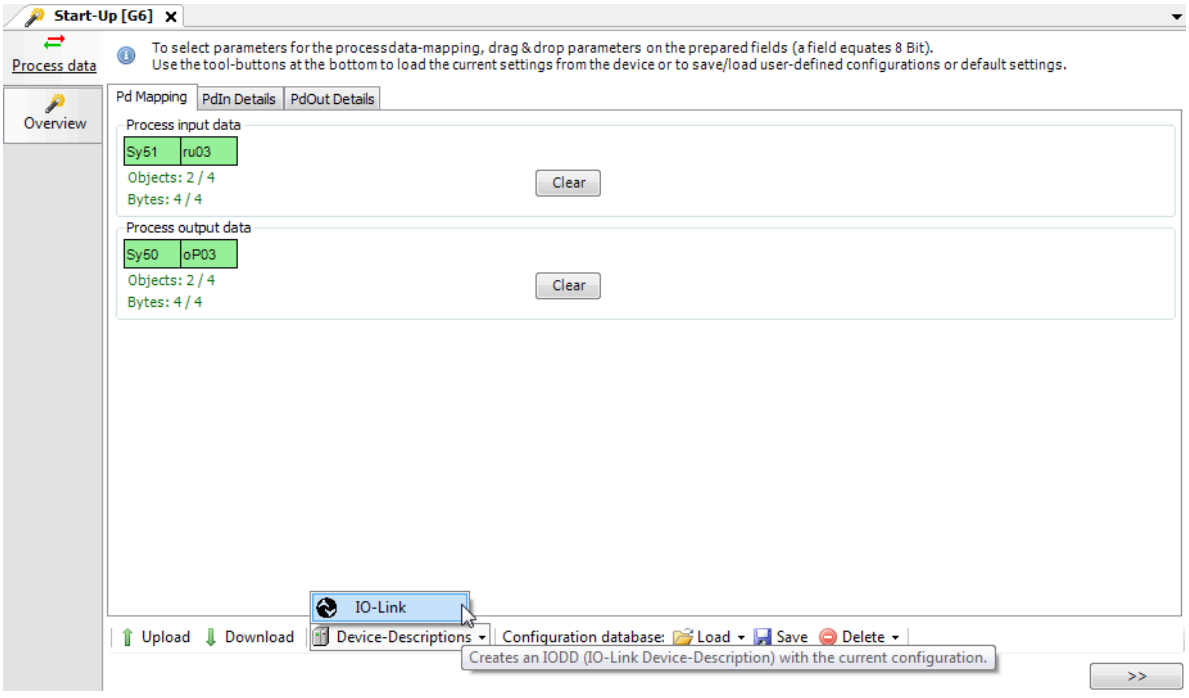


Figure 2: Start-up assistant: PD Mapping

6 Fieldbus Watchdog

The fieldbus watchdog is a function in the IO-Link control card. It is used to trigger an error or warning in the inverter, if certain events are not cyclically repeated within a certain time. The activation of the watchdog is set by the control card parameters fb04 and fb05. The monitoring time and the at exceeding of the monitoring time executed function is set by parameter in the inverter (pn05, pn06).

Id-Text	Name	Parameter index
fb40	buswatchdog activation	0x21A8
Meaning	Allows a delayed activation of the fieldbus watchdog after switching on the device.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: off (fieldbus watchdog inactive) 16: Activation after the first asynchronous communication 32: Activation by setting the master command to „Processdata output operate“ (0x98) 128: Activation by any communication via the IO-Link interface Standard value: 0	
Note	Possible settings are OR connected.	

Id-Text	Name	Parameter index
fb41	buswatchdog inhibit	0x21A9
Meaning	Determines on which incidents the fieldbus watchdog gets reseted.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: off (no reset) 16: The watchdog is reset upon receipt of process output data. 128: Reset by any communication via the IO-Link interface Standard value: 0	
Note	Possible settings are OR connected.	

7 Events

In case of an occuring event, the device sets the so-called "event flag", which is transmitted in the process data telegram CHECK/STAT byte in bit 7. The master detects the set bit and reads the reported event. During the reading of an event, no service data can be exchanged. By this way it is possible to transfer events or states of a device via the IO-Link master to the PLC or visualization.

The COMBIVERT G6 supports detailed events.

The following events are supported:

Cur-No.	Eventcode	EventQualifier	Description
1	0x8CA0 (manufacturer specific)	Instance: Application Type: Information Mode: Single shot	Sent when PD-in count fb19 is set to 0, or when communication to the power unit is lost or gets restored.

The "PD valid" bit in the event service is also set when valid process data are sent from the power unit to the IO-Link master.

Id-Text	Name	Parameter index
fb27	synchronization state	0x219B
Meaning	State of synchronization to the fieldbus cycle	
Type	Variable	
Data length	8 bit	
Access	read	
Coding	0: off (device not synchronous) 1: on (device synchronous) Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
fb28	pd access time	0x219C
Meaning	Processing time, which is required, to process the PD data (from FPGA sync until the end of processing with fully-utilized process data length in both directions).	
Type	Variable	
Data length	8 bit	
Access	read	
Coding	0...500 µs Standard value: 0 µs	
Note	-	

8 General Control Card Parameters (Operator Functionality)

The operator parameters determine the configuration of the G6 IO-Link control. Furthermore, the software version as well as the current state can be read.

Id-Text	Name	Parameter index
os00	operator identifier	0x2080
Meaning	Displays the control card type, as well as the software version.	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	e.g.: 150405 15xxxx: G6 xx05xx: IO-Link xxxx05: Version of the parameter configuration Standard value: Device dependent	
Note	-	

Id-Text	Name	Parameter index
os02	software date OS	0x2082
Meaning	Software date of the control card	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0.0000…9999, 1231: The year is displayed before the comma, month and day are after that. 2012,0813 means 13.08.2012. Standard value: 0.0000	
Note	-	

Id-Text	Name	Parameter index
os03	software version	0x2083
Meaning	Software version of the control card	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0.0.0.0…255.255.255.255 e.g.: 1.3.0.1 Standard value: 0.0.0.0	
Note	-	

Id-Text	Name	Parameter index
os04	diag error count	0x2084
Meaning	Specifies the number of errors occurred on the diagnostic interface.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...255 Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os05	diag response delay time	0x2085
Meaning	Sets the minimum response delay time for requests on the diagnostic interface.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...126 ms Standard value: 0 ms	
Note	-	

Id-Text	Name	Parameter index
os06	baud rate diag	0x2086
Meaning	Default transfer speed on the diagnostic interface.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: 1.2 kbit/s 1: 2.4 kbit/s 2: 4.8 kbit/s 3: 9.6 kbit/s 4: 19.2 kbit/s 5: 38.4 kbit/s 6: 55.5 kbit/s 7: 57.6 kbit/s 8: 100 kbit/s Standard value: 5	
Note	-	

Id-Text	Name	Parameter index
os07	node ID	0x2087
Meaning	This parameter specifies the inverter address for the diagnostic interface (DIN 66019). The parameter is an image of the system parameter Sy06.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...239 Standard value: 1	
Note	-	

Id-Text	Name	Parameter index
os08	operator type	0x2088
Meaning	Displays the implemented control card functions.	
Type	Variable	
Data length	16 bit	
Access	read	
Coding	Bit 0 / Initiator / 0: without 1: with initiator Bit1 / Keyboard/display / 0: without 1: with keyboard/LC display Bit 8 / PU image / 0: with power unit image 1: without power unit image Bit 10 / f = 0Hz / 0: without 1: with f=0Hz functionality Bit 11 / STO / 0: without safety function 1: with safety function STO Bit 12...13 / Bus connection / 0: without (standard) 1: CANopen 2: IO-Link 3: EtherCAT 4: VARAN Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os09	PU max invbusy retries	0x2089
Meaning	Number of repetitions that are sent on the internal bus from the power module to the controller if it rejects "inverter busy" error.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...255 Standard value: 200	
Note	-	

Id-Text	Name	Parameter index
os10	PU tout count	0x208A
Meaning	Counts the timeouts on the internal bus between control and power unit.	
Type	Variable	
Data length	16 bit	
Access	read / write	
Coding	0...65535 Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os12	operator command	0x208C
Meaning	Default of instructions according to coding (see below)	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: no 1: Load default values in all operator parameters 2: reinitialize PU-parameter image Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os13	operator state	0x208D
Meaning	Displays the state of the power unit, as well as the image of the power unit parameter of the control card.	
Type	Variable	
Data length	8 bit	
Access	read	
Coding		

Bit 0	reserved	
Bit 1...2	PUConfIDState	0: PU-ID unknown 2: PU-ID OK 4: PU-ID incorrect
Bit 3...5	PU image state	0: PU-Image not init. 1: write PU image 3: PU-Image changed 4: PU-Image init. 5: PU-Image check 6: PU image not available
Bit 6...15	reserved	

Standard value: 0

Note	-

Id-Text	Name	Parameter index
os14	store state	0x208E
Meaning	Non-volatile parameters are immediately stored by writing of value "0". After completion of the storage the value jumps to status "1". If at the end of the download lists in COMBIVIS the value "0" comes before value "1", COMBIVIS will send the value as long as the inverter has completed the storing.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: busy 1: ready 2: off Standard value: 1	
Note	-	

Id-Text	Name	Parameter index
os15	store mode	0x208F
Meaning	The memory type of non-volatile parameters must be adjusted with this parameter. The parameters will not be stored if the value is "0", the device automatically changes to value "1" after the next "power down". This value is the default value, the non-volatile parameters are always stored. Value „2“ deactivates the storing, also over the next start of the module.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: off, curr. off / on at startup 1: on, always store 2: off, never store Standard value: 1	
Note	-	

Id-Text	Name	Parameter index
os17	safety type	0x2091
Meaning	Type of safety module	
Type	Variable	
Data length	16 bit	
Access	read	
Coding	0: no safety module available 1: Type 1 (STO) Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os18	safety software date	0x2092
Meaning	Displays the software date of the safety module.	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0.0000...9999, 1231: The year is displayed before the comma, month and day are after that. 2012,0813 means 13.08.2012. If no safety module is installed, the value "0: no safety functionality“ is displayed. Standard value: 0	

Id-Text	Name	Parameter index
os19	safety software version	0x2093
Meaning	Displays the software version of the safety module.	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0.0.0.0...255.255.255.255 If no safety module is installed, the value "0: no safety functionality“ is displayed. Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os20	safety signals state	0x2094
Meaning	Displays the signal state of the safety module.	
Type	Variable	
Data length	8 bit	
Access	read	
Coding		

Bit 0	no safety functionality	1: no safety functionality
Bit 1...2	Error STO	1: Error STO 2: STO OK
Bit3	ModFeedback	4: ModFeedback ist set 8: ModFeedback ist not set
Bit 4...5	ST Safety	16: ST is set 32: ST is not set
Bit 6...7	PU alive	64: PU alive 128: PU not alive

Standard value: 0

Note	-

Id-Text	Name	Parameter index
os21	safety information	0x2095
Meaning	Displays the error code of the safety module	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0...65535 Standard value: 0	
Note	-	

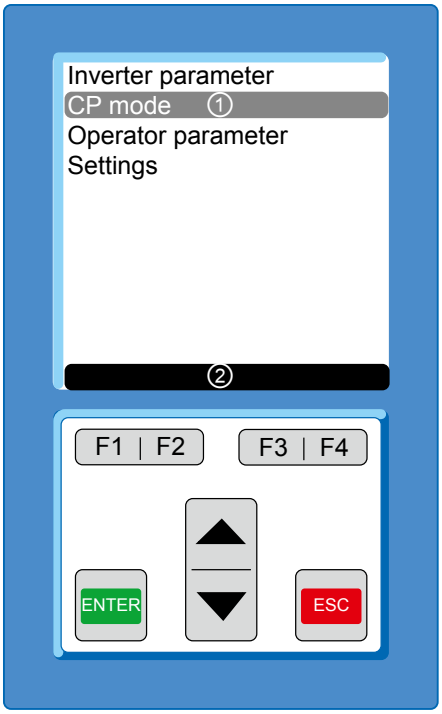
Id-Text	Name	Parameter index
os23	current PU ID	0x2097
Meaning	Displays of the power unit Id	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0...65535 Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
os30	serial number OS 2	0x209E
Meaning	Serial number part 2 of the control hardware.	
Type	Variable	
Data length	32 bit	
Access	read	
Coding	0…4294967295 Standard value: 0	
Note	-	

9 LC Display Operation

For optional assembly of the LC display.

9.1 Control elements



Name	Function
①	Menu bar
②	Function bar
F1	Function key 1
F2	Function key 2
F3	Function key 3
F4	Function key 4
▲	Menu bar up or increase parameter value
▼	Menu bar down or decrease parameter value
ENTER	select / confirm
ESC	return to the superordinate menu

Figure 3: Control elements

9.1.1 Description of controls

9.1.1.1 Menu bar

The menu bar shows the current selection in the menu. It can be moved with the ▲ and ▼ keys. Press Enter to change to the subordinate operating level, ESC to return to the next higher operating level.

9.1.1.2 Function keys and toolbar

The function keys F1...F4 are variable assigned depending on the menu item. The toolbar displays current assignment of the function keys F1 ... F4.

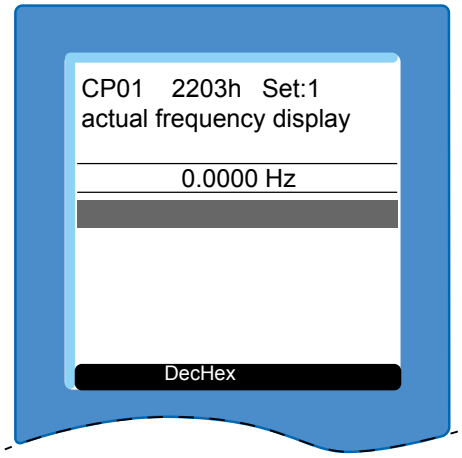
The keys can have the following assignment:

Display	Function
DecHex	Display changes between decimal and hexadecimal display
Menu	jumps to the main menu
Up	jumps to the top of the current page, repeated pressing scrolls back one page
Down	jumps to the end of the current page, repeated pressing scrolls forward to the next page

Table 1: assignment of the function keys

9.2 Initial start-up

9.2.1 Switch on



At the first switch on with factory setting the operator indicates the actual frequency in the customer parameter menu (CP mode).
To make the basic settings change to the main menu as follows:

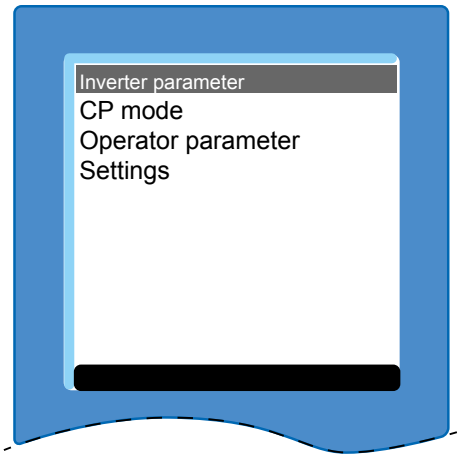
<ESC> → changes to the parameter selection

<F1> → jumps to the main menu

Info The startup menu can be defined under "Start mode".

Figure 4: Power-on indicator

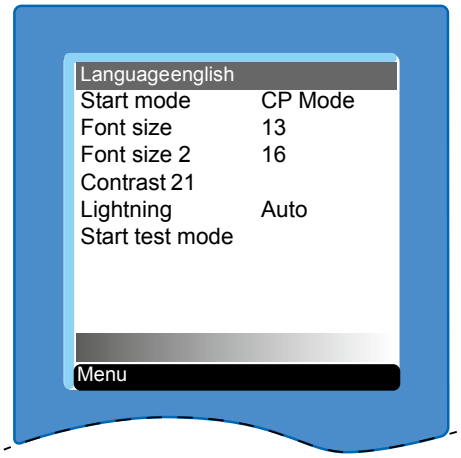
9.2.2 Main menu



The main menu is the top-level menu. With the keys <▲> and <▼> select the desired submenu. Press <ENTER> to jump to the selected submenu.

Figure 5: Main menu

10 Basic settings



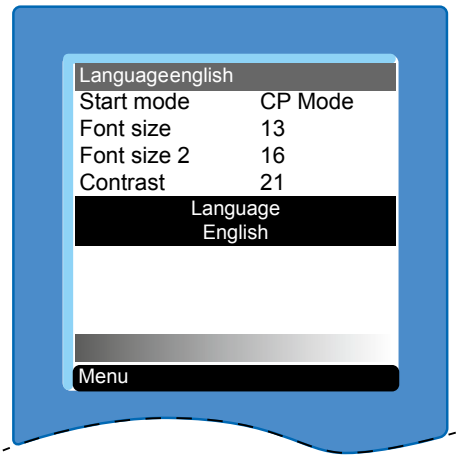
To adjust the display to the individual needs select "Settings" in the main menu and confirm with <ENTER>.

With the keys <▲> and <▼> select the desired function.

Press <ENTER> to switch into the input mode to change the parameter value.

Figure 6: Basic settings

10.1 Change language



Press <ENTER> to switch into the input mode to change the parameter value. With the keys <▲> and <▼> select one of the following languages:

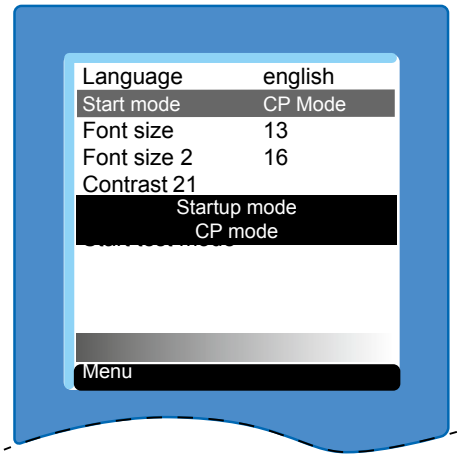
- German
- English
- Espanõl
- Russian
- Italiano
- Francais
- American

<ENTER> selects the desired language and jumps back into the "Settings" sub-menu.

Info The parameters are displayed in English if the selected language is not available.

Figure 7: Change language

10.2 Startup mode



The startup mode determines which display appears at switch on.

Press <ENTER> to switch into the input mode to change the parameter value.

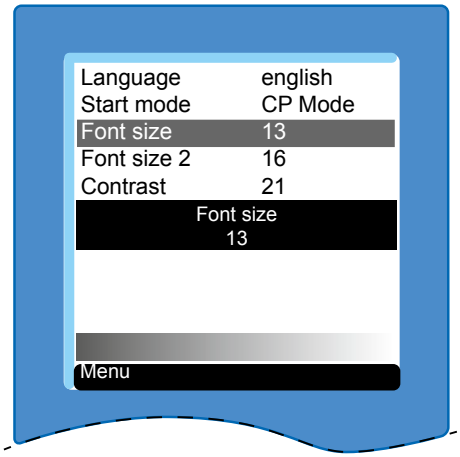
With the keys <▲> and <▼> select one of the following home screens:

- Inverter parameter
- CP Mode (customer parameter)
- Operator parameter
- Settings

<ENTER> selects the desired startup screen and jumps back into the "Settings" submenu.

Figure 8: Set start mode

10.3 Set font size and font size 2



The font size determines the complete menu view in the display except for the font size 2 (see below).

Press <ENTER> to switch into the input mode to change the parameter value.

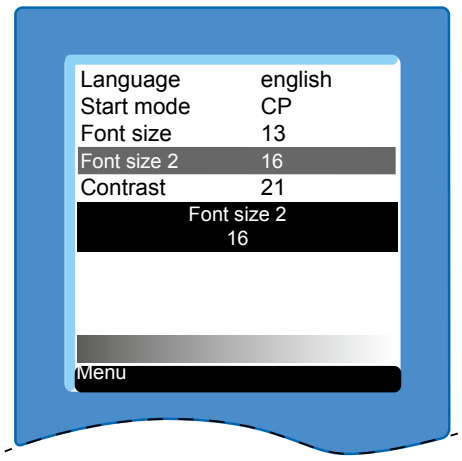
With the keys <▲> and <▼> select one of the following font sizes:

- 8, 10, 13, 16, 24

<ENTER> selects the desired font size and jumps back into the "Settings" submenu.

The display will only be updated after a change of the menu.

Figure 9: Set font size



The font size 2 determines the display size of the parameter values in CP mode.

Press <ENTER> to switch into the input mode to change the parameter value.

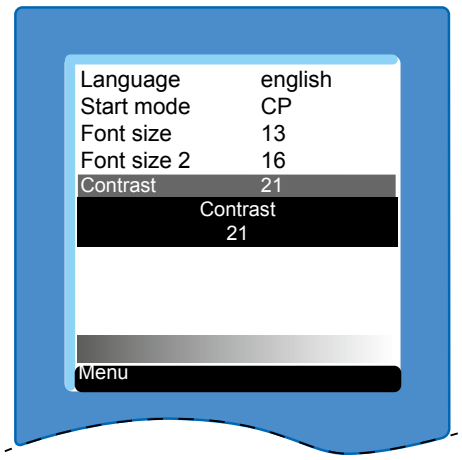
With the keys <▲> and <▼> select one of the following font sizes:

- 8, 10, 13, 16, 24

<ENTER> selects the desired font size and jumps back into the "Settings" sub-menu.

Figure 10: Set font size 2

10.4 Contrast settings



Sets the contrast level of the LC display.

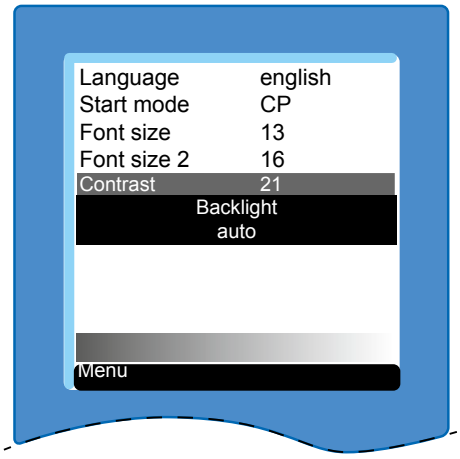
Press <ENTER> to switch into the input mode to change the parameter value.

With the keys <▲> and <▼> set the contrast level from 0...50. Use the contrast bar on the bottom of the toolbar to control the settings.

<ENTER> stores the specified contrast setting and returns to the "Settings" submenu.

Figure 11: Contrast settings

10.5 Setting the backlight of the display



The menu item "Lighting" defines the behavior of the backlight of the LC Display.

Press <ENTER> to switch into the input mode to change the parameter value.

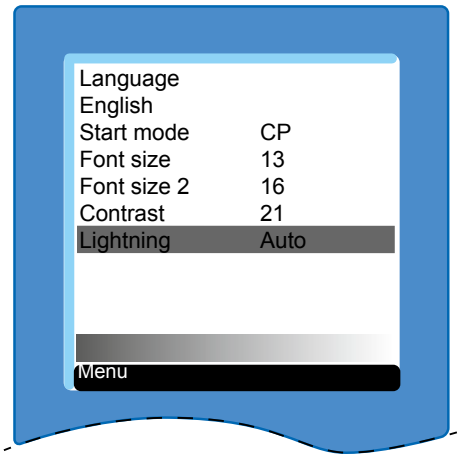
With the keys <▲> and <▼> select one of the following settings:

- on → generally on
- off → generally off
- auto → on when pressing a button; off after 10 seconds of non-operation

<ENTER> selects the desired backlight and jumps back into the "Settings" submenu.

Figure 12: Backlight settings

10.6 Functional test of keyboard and display

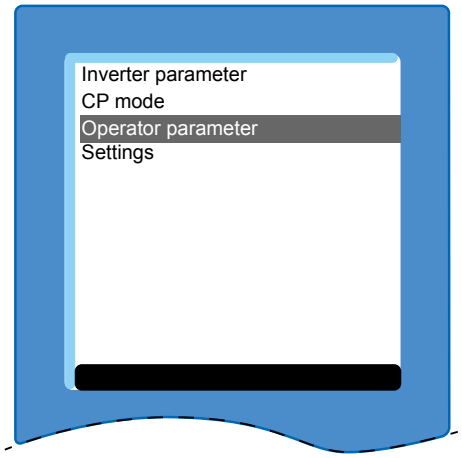


<ENTER> starts a test mode, which allows you to test the function of each button and the LCD display.

Follow the instructions on the screen during the test run.

Figure 13: Functional test of keyboard and display

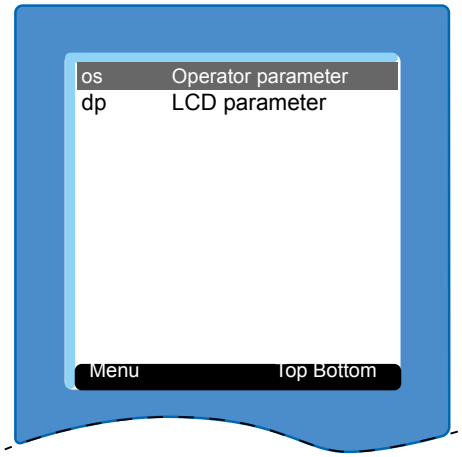
11 Operator parameter



Use the operator parameters to configure the control card, the fieldbus (if available) and the display.

With the keys < ▲> and <▼> select "Operator parameter" and confirm with <ENTER>.

Figure 14: Operator parameter



The control card parameters at the analog / digital control are divided into two groups:

- os - operator system parameters; Display and setting of the control card
- dp - LC display parameter; Configuration of the LC display via bus

With the keys <▲> and <▼> select the corresponding parameter group.

<ENTER> switches to the selected sub-menu.

Figure 15: Select control board parameter group

11.1 Parameters for LC display setting

The settings of the LC parameters are completely accepted from the LC display only after restarting the device.

Id-Text	Name	Parameter index
dp00	language	0x2780
Meaning	A language is selected for the menu and the parameters. If the selected language is not available the parameters are displayed in English.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: English 1: German 2: American 3: France 4: Italian 5: Russian 6: Spanish Standard value: 0	
Note	-	

Id-Text	Name	Parameter index
dp01	startup mode	0x2781
Meaning	The startup mode determines the menu item after initialization of the control.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0: Inverter parameter 1: CP mode 2: Operator parameter 3: Menu Standard value: 1	
Note	-	

Id-Text	Name	Parameter index
dp02	font size	0x2782
Meaning	It can be selected between font sizes 8.10.13.16 and 24 in the display. Exception: see parameter „font size 2“	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	8: 8dpi 10: 10dpi 13: 13dpi 16: 16dpi 24: 24dpi Standard value: 13	
Note	-	

Id-Text	Name	Parameter index
dp03	font size 2	0x2783
Meaning	The font size for the display of parameter values is specified in the CP mode.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	8: 8dpi 10: 10dpi 13: 13dpi 16: 16dpi 24: 24dpi Standard value: 16	
Note	-	

Id-Text	Name	Parameter index
dp04	contrast	0x2784
Meaning	The contrast settings of the LC display can be changed to optimize readability.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0...50 Standard value: 21	
Note	-	

Id-Text	Name	Parameter index
dp05	backlight	0x2785
Meaning	The contrast settings of the LC display can be changed to optimize readability.	
Type	Variable	
Data length	8 bit	
Access	read / write	
Coding	0 off Lighting of the LC display generally off. 1 on Lighting of the LC display generally on. 2 auto If the backlight is adjusted to "auto", it is switched on during pressing a key and switched off again after 10 seconds if no key is pressed. Standard value: 2	
Note	-	

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