Service menu guide
PRO-33.0-TL string inverters

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ABB

List of related manuals

PRO-33.0-TL manuals	Code (English)
PRO-33.0-TL quick installation and start-up guide	3AUA0000123263
PRO-33.0-TL product manual	3AUA0000123261
PRO-33.0-TL service menu guide	3AXD50000015823

Option manuals and guides	
FIO-01 Digital I/O Extension user manual	3AFE68784921
VSN700 Data Logger	9AKK106103A7625
FIO-11 User's Manual	3AFE68784930
FENA-01/-11/-21 Ethernet adapter module user's manual	3AUA0000093568
FSCA-01 RS-485 adapter module User's manual	3AUA0000109533
Drive composer Start-up and maintenance PC tool User's manual	3AUA0000094606

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Service menu guide

PRO-33.0-TL string inverters

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1

Service menu

Contents of this chapter

This chapter describes the Service menu, when to use it and how to access it.

Service menu overview
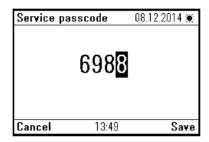
In the basic use of the inverter you do not need the Service menu. However, some of the inverter features are accessible only from the Service menu. For example, you can make custom settings for countries that are not defined in the inverter software or adjust the inverter's operating parameters to better meet the local requirements.

Accessing Service menu

1. From the screen saver display or output view screen, simultaneously push the left soft key, right soft key and **Help** button. If you push one button before the others, you need to try again.

2. Enter the PIN 6988. Use the up, left and right arrows to enter the digits. Press the right soft key to save.

3. Scroll down the menu and enter the **Service** submenu. The heading **Parameters** is now shown on the list.

Exiting Service menu

If you do not press any buttons on the inverter for a preset period of time, the screen saver turns on and you exit the Service menu. For instructions on changing the screen saver delay, see chapter *Setting screen saver delay* on page *11*.

To exit the Service menu before the preset period expires, for example, to prevent anyone from altering parameters in your absence:

1. From the screen saver display or output view screen, simultaneously push the left soft key, right soft key and help button.

2. Push **Cancel** without entering the PIN.

Setting screen saver delay

If you do not press any buttons on the inverter for a preset period of time, the screen saver turns on and you exit the Service menu. To return to the Service menu, see *Accessing Service menu* on page *9*. If an assistant is active or waiting for a response from the user, the screen saver does not turn on.

Before using the Service menu, increase the preset screen saver delay so you do not need to repeatedly access the menu. This is useful especially when the delay is short. You can change the screen saver delay from the Screen menu and set the value from 30 seconds to 10 minutes. Remember to reset the delay back to the original value after you have finished working with the Service menu.

Parameters you are allowed to change

It is possible to change parameters and their values through the Service menu almost without any restrictions. But you are allowed to change only the parameters and their values such that they comply with relevant local requirements and regulations as set by the local authority.

2

Program features

Contents of this chapter

This chapter describes the software features of the PRO-33.0-TL inverter. Each feature is described in detail with a list of parameters and related faults and warnings, wherever applicable.

See,

Control and monitoring interfaces

In basic setup the operation of PRO-33.0-TL inverter does not require any user actions. Once the inverter is commissioned, automatic functions start and stop the inverter based on measurements.
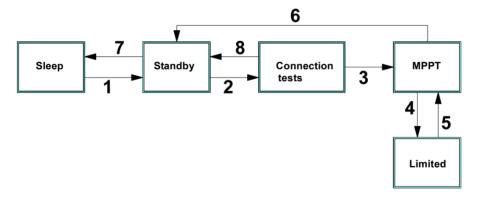
In some cases the inverter requires monitoring and additional control. You can control and monitor the inverter locally from the control unit and remotely through the fieldbus interface.

The control unit operation and menu structure are described in the *PRO-33.0-TL Product manual* (3AUA0000123261 [English]).

Operational description

PRO-33.0.-TL inverter operation follows the state machine described below.
- *MPPT* is the normal operational state during power generation.
- If a power limitation is active, the inverter is in the *Limited* state while the inverter produces energy to the grid.
- When the DC power level from panels is low, the inverter is in the *Sleep* or *Standby* state depending on the night mode settings (parameter *189.07 Night mode*).
- *Connection tests* is a state the inverter goes through every time it connects to the grid and performs tests for DC voltage and internal protection devices.
- If a fault occurs, the inverter moves to the *Standby* state and waits for a reset command (manual or autoreset).
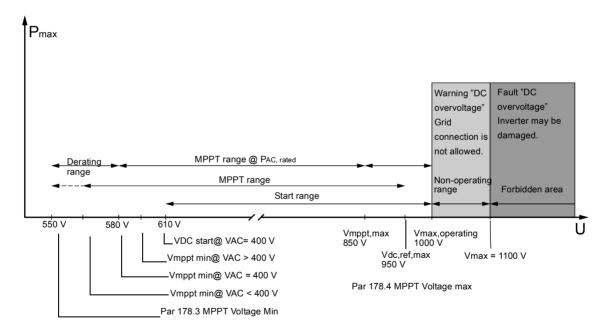
The conditions for state transitions are as follows:

1	VDC > ~300 V
2	Inverter enabled (parameter *189.01 Inverter operation*) **AND** country code set **AND** grid stable **AND** $VDC > VDC_{start}$ **AND** $VDC < VDC_{max}$ **AND** no faults
3	$VDC > VDC_{start}$ **AND** ground impedance ok **AND** grid relay ok
4	Available power is greater than the inverter's power limit (parameter *130.01 Limit word 1*) $P_{lim} < P_{act}$

5	Available power is less than the inverter's power limit $P_{act} < P_{lim}$
6	Inverter disabled (parameter *189.01 Inverter operation*) **OR** fault **OR** grid unstable **OR** VDC low **OR** VDC > VDC_{max} **OR** FRT overshoot
7	No monitoring mode (parameter *189.07 Night mode*) **AND** VDC < VDC_{sleep} **AND** Control unit screensaver active **AND** No events active
8	Inverter disabled (parameter *189.01 Inverter operation*) **OR** fault **OR** grid unstable **OR** VDC < VDC_{start}

DC voltages and maximum power point tracking

The following picture visualizes the operational voltage ranges of the PRO-33.0.-TL inverter. The input operation voltage range depends on the AC voltage and it is between 580 and 950 volts when the AC voltage is nominal 400 V_{AC}.

- MPPT range @ $P_{AC, rated}$ = maximum power available with tracking, no derating
- MPPT range = maximum power tracking range, power may be derated.
- Start range = Input voltage range where inverter may start

Start range

The inverter starting range is between 610 V and 1000 V. The minimum startup voltage depends linearly on AC voltage. 610 V is valid at nominal AC voltage 400 V_{AC}. If the voltage at start is greater than 950 V, it is regulated down to 950 V where tracking is started.

DC overvoltage monitoring

If the DC voltage is over 1000 V, the inverter gives a DC overvoltage warning and grid connection is not allowed. The inverter may be damaged if the input voltage is higher than 1100 V_{DC}. If the DC voltage is over 1100 V_{DC}, the inverter gives the DC overvoltage fault.

Maximum power point tracking range

Maximum power point tracking (MPPT) range with rated Power $P_{AC,rated}$ is available between 580 V and 850 V under nominal conditions and at nominal AC voltage. See MPPT range @ $P_{AC,rated}$ in the figure on page *15*. Maximum power point tracking operates up to 950 V, but the available inverter maximum power between 850 V and 950 V depends on the temperature inside the inverter.

The MPPT range operates between V_{MPPT_min} and 950 V. The V_{MPPT_min} is the higher value of either the parameter *178.03 Minimum voltage ref* or the voltage level that depends on the AC voltage. The default value for parameter *178.03 Minimum voltage ref* is 550 V and nominal value for the V_{MPPT_min} is 580 V @ 400 VAC.

The inverter topology is a single stage inverter which means that the inverter does not have a DC / DC booster. Thus the inverter startup voltage and minimum/maximum power point voltage depends linearly on the AC output voltage.

- If the available PV power is greater than the derated power of the inverter, MPP tracking is disabled and DC voltage is determined by the PV curve. The inverter limits the output power while the voltage rises, but the inverter stays connected to the grid unless the voltage exceeds 1000 V.

- If the available PV power is smaller than the derated power of the inverter, MPP is tracked within the operating voltage range. MPP tracking operates up to 950 V after which the inverter clamps the DC voltage to 950 V. MPP is not allowed and will not push the operation point above 950V.

DC current limiting

The inverter controls its output power such that the DC input current does not exceed 58 A. The lowest DC input voltage that provides maximum output power is 580 V under nominal conditions.

Settings

178.03 Minimum voltage ref

178.04 Maximum voltage ref

Diagnostics

101.10 DC voltage

Country settings

■ Preset country codes

The PRO-33.0-TL inverter has a country code table with preset grid code settings for 37 countries. The installation country is initially set with the First start assistant or with the parameter *188.01 Country code*.

The First start assistant activates automatically when the inverter is turned on for the very first time. See more details in the *PRO-33.0-TL Product manual.* The country code may also have separate options for low voltage and medium voltage settings when there are separate requirements for MV connection in the same country, such as Germany LV and Germany MV. If the country code is not set, the inverter does not operate.

When a country code is selected, all the necessary parameter settings are set to match the country requirements. The country code settings affects the parameters in the groups *124 Q ref*, *130 Limits, 178 MPPT settings*, *188 Grid monitoring*, *189 Inverter control* and *209 Misc*. The parameters include, for example, nominal output values, tripping limits for under- and overvoltage and under- and overfrequency, initial connection delays, variety of reconnection delays, anti-islanding settings, reactive power settings, fault ride-through settings, power limitation settings and MPPT recovery settings. Usually the country code is not changed during the lifetime of the inverter.

You can change the country code with parameter *188.01 Country code*.

Note: Changing this value will always override any changes made in the above-mentioned parameter groups.

When a country code is initially set, all the preset parameters can be modified if they adhere to the local grid code requirements. See details in chapter *Customizing country code settings* on page *17*.

Settings

188.01 Country code

Diagnostics

172.01 Connection status

■ Customizing country code settings

If the country code-related parameter settings (parameters in groups *124 Q ref*, *130 Limits, 178 MPPT settings*, *188 Grid monitoring*, *189 Inverter control* and *209 Misc*) need to be changed, follow this procedure:

Disable the inverter

1. Enter the **Service** menu.
2. Select **Inverter operation** and press **Edit**.
3. Change the value from **Enable** to **Disable** and press **Save**. After a short period, the inverter stops running and it is possible to change the parameter values.

Customize settings

1. Enter the parameter list: **Service menu** - **Parameters** - **Complete list**.
2. Check that you have a country code set with parameter *188.01 Country code*.
3. Make required changes to the parameters.

Enable the inverter and save the parameter changes to permanent memory

1. Set parameter *189.01 Inverter operation* to **Enable**.

2. Refresh the settings by setting the parameter *188.05 Refresh*.

3. Save parameter values by setting the parameter *196.07 Param save*.

Grid monitoring

The PRO-33.0-TL inverter monitors the grid conditions with internal measurements. The measured values are compared against the limits set in the parameter group *188 Grid monitoring*. If the measured value does not stay within the limit for a certain minimum period of time, the inverter declares the grid as unstable. All grid monitoring settings are reset when the country code is changed.

Notes:
- If the grid monitoring settings are changed, do a parameter refresh with the parameter *188.05 Refresh*.
- Depending on the installation country, an external third party-certified grid monitoring relay may be needed.

■ Nominal values

Note: The fault ride-through settings must be taken into account when defining grid monitoring.

The inverter monitors either line-to-line voltages or line-to-neutral voltages. This is selected with the parameter *188.06 Voltage source* that can be set to **Main** or **Phase**, respectively. The settings for grid monitoring are set in relation to the nominal value.

Settings

188.02 Nominal LL voltage

188.03 Nominal phase voltage

188.04 Nominal frequency

188.06 Voltage source

■ Connection delays

Typically, it is required that the grid must be stable for some time before grid connection is allowed. For this purpose there is a set of delays.
- *188.10 Initial connection delay* defines the delay that must expire before the first grid connection after a power-up can be made.
- *188.11 Reconnection delay* defines the delay that must expire after a disconnection before the following reconnection.
- *188.13 Quick reconnection delay* is used if the grid is unstable for less than the value defined in parameter *188.12 Quick disturbance limit*. Thus a short unstable grid allows a faster reconnection. If the parameter *188.12 Quick disturbance limit* is set to **0**, quick reconnection is not used.

Settings

188.10 Initial connection delay

188.11 Reconnection delay

188.12 Quick disturbance limit

188.13 Quick reconnection delay

◼ Connection limits

The grid monitoring function of the inverter includes a connection condition checking that is used only in a grid connection. Typically, the connection limits are stricter than the disconnection limits. The connection limits are also referred as "cut-in" conditions.

There are connection limits for underfrequency, overfrequency, overvoltage and undervoltage. Each phase/main voltage is independently monitored.

Settings

188.20 Connect underfrequency type

188.21 Connect underfrequency limit

188.22 Connect overfrequency type

188.23 Connect overfrequency limit

188.24 Connect undervoltage type

188.25 Connect undervoltage limit

188.26 Connect overvoltage type

188.27 Connect overvoltage limit

◼ Voltage monitoring

There are two limits for undervoltage monitoring and three limits for overvoltage monitoring. Each limit has an enable parameter, a limit parameter and a time parameter.

When the limit is enabled and the measured value exceeds the limit for the time, the grid is declared as unstable. All limits are logically connected in parallel. Each phase/main voltage is independently monitored.

Settings

188.50 Undervoltage enable 1 -- 188.71 Overvoltage time 3

◼ Sliding overvoltage

Sliding overvoltage implements the monitoring of the slowly rising AC voltage. A 10 minutes average value is calculated and compared against the limit. Each phase/main voltage is independently monitored.

Settings

188.72 Sliding overvoltage enable

188.73 Sliding overvoltage limit

188.74 Sliding overvoltage time

◼ Frequency monitoring

There are two limits for underfrequency and overfrequency monitoring. Both the limits have an enable parameter, a limit parameter and a time parameter.

When the limit is enabled and the measured value exceeds the limit for the time, the grid is declared as unstable. All limits are logically connected in parallel.

Settings

188.30 Underfrequency enable 1 -- 188.45 Overfrequency time 2

◼ Combinatory limit

Combinatory limit monitors grid voltage and frequency simultaneously. There are limits for the positive sequence and the negative sequence of grid voltage, and limits for underfrequency and overfrequency.

The grid is declared as unstable, if the
- negative sequence voltage and the frequency are outside their limits, or
- positive sequence voltage and the frequency are outside their limits.

If either of the conditions is true for the time defined in parameter *188.81 Combinatory trip time*, the grid is declared as unstable and the inverter disconnects from the grid.

Settings

188.80 Combinatory trip

188.81 Combinatory trip time

188.84 Comb pos seq voltage limit

188.85 Comb neg seq voltage limit

188.86 Comb underfrequency limit

188.87 Comb overfrequency limit

◼ Rate of change of frequency

The grid frequency rate of change (RoCoF) has enable and limit parameters. If it is enabled and the limit is exceeded, the inverter disconnects from the grid.

◼ Active anti-islanding

The anti-islanding function is used to prevent an island situation in an electrical grid. Island in a grid is a situation in which a generator powers part of the grid even though the power from the utility grid is cut off. Islanding can be dangerous to people working with the grid and not realizing that the circuit is still powered. For that reason, distributed power generators such as solar inverters must detect an island situation and immediately stop feeding power to the grid.
- The anti-island function is based on a so called active method whereby reactive current is injected into the grid. The actual detection of a islanding condition is based on grid voltage measurements. The function can be configured with parameters. The parameters are preset to such values that ensure that the relevant country-dependent requirements are fulfilled.

Settings

188.120 1-phase AI

◼ External grid monitoring relay

Depending on the installation country, an external third party-certified grid monitoring relay may be needed. If an external relay is used, loose limits for grid monitoring should be set. The recommended setting for overvoltage monitoring limit is 130%. The limit for undervoltage monitoring should be set below the external relay setting.

The inverter can be controlled by external grid monitoring equipment through parameter *188.16 External trip*. If value one (1) is written to this parameter the external monitoring device indicates to the inverter that the grid is unstable. As a result the inverter trips.

Settings

188.16 External trip

Reactive power control

The inverter is capable of generating a selectable amount of reactive power to the grid (positive = capacitive, negative = inductive). A reference value for the reactive power can be given through the control unit or fieldbus interface. The inverter also supports reactive power generation according to predefined curves such as Q(U) and Q(P).

A reference type for the reactive power can be selected from a number of different formats, see parameter *124.06 Q power ref type.* The actual reactive reference value for the selected type must be written to the parameter *124.01 User Qref*.

When parameter *124.06 Q power ref type* is set to **Q(x) regulation curve**, parameter *124.30 Q(x) curve* is used to select the curve type. Examples of different curve types are shown below. Lock-in and lock-out conditions define when the selected curve is active. The curve is defined with six points that map the input signal to the output signal.

Reactive power control curve activates when lock-in conditions are fulfilled and deactivates when lock-out conditions are fulfilled. Lock-in condition can be set so that the curves are always active (set to zero (power>0)).

Settings

124.01 User Qref

124.06 Q power ref type

124.30 Q(x) curve

Active power limitations

■ External active power limit
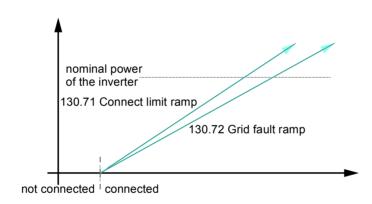
Inverter output power can be limited by writing a new value for maximum output power in parameter *130.75 External power limit*. The external power limit has ramps *130.98 External limit ramp up* and *130.99 External limit ramp down*.

Settings

130.75 External power limit

130.98 External limit ramp up

130.99 External limit ramp down

■ Limitation after grid connection and after grid fault

Active power can be limited after grid connection and after grid fault. The limitation type is selected with parameter *130.70 Connect limit type*. The limitation can be set to be active always, only after grid fault or never. There are different ramp rates for grid connections and re-connections after grid faults. Limitation ramp starts from 0%. Ramp is defined as% / min.

Settings

130.70 Connect limit type

130.71 Connect limit ramp

130.72 Grid fault ramp
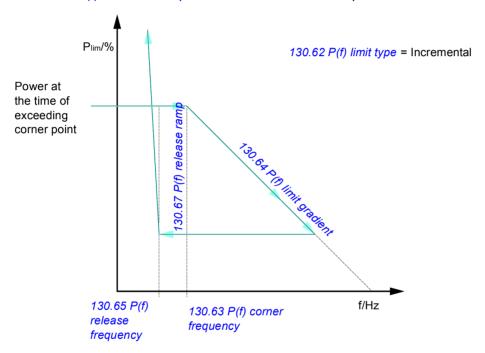
■ Limitation based on grid frequency

Power limitation based on grid frequency can be set to operate in different ways depending on the selected limitation type. This section describes some of the most common limitation types. The P(f) limitation type is selected in parameter *130.62 P(f) limit type*.

P(f) limitation curve based on Germany MV grid code

This is an example of an *incremental* P(f) limitation.

Frequency is defined with parameter *130.63 P(f) corner frequency*. When frequency is crossed, the power value is saved and the power limit is calculated in relation to that power. The limit may decrease only until the frequency drops below the value defined in parameter *130.65 P(f) release frequency*. Then the power limit is ramped up with the parameter *130.67 P(f) release ramp* in relation to the nominal power.

Settings

130.62 P(f) limit type

130.63 P(f) corner frequency

130.64 P(f) limit gradient

130.65 P(f) release frequency
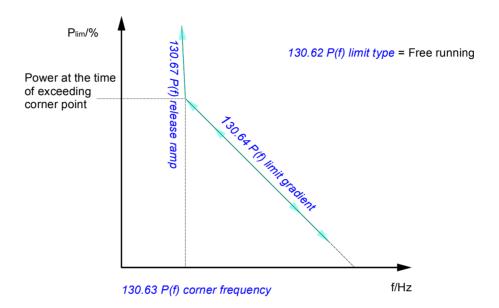
130.67 P(f) release ramp

130.68 P(f) release ramp ref

P(f) limitation curve based on Germany LV grid code

This is an example of a *free running* P(f) limitation.

When *130.63 P(f) corner frequency* is crossed, power is saved and the power limit is calculated in relation to that power. The limit may change freely at the frequencies above the corner frequency. When the frequency drops below *130.63 P(f) corner frequency*, power limit is ramped up with the parameter *130.67 P(f) release ramp* in relation to nominal power.

Settings

130.62 P(f) limit type

130.63 P(f) corner frequency
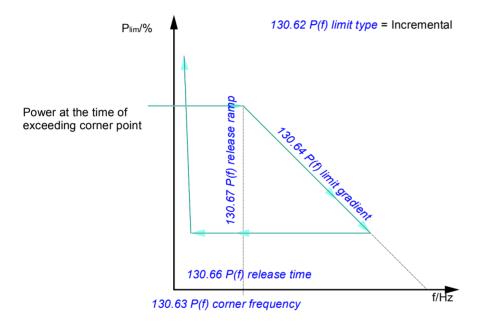
130.64 P(f) limit gradient

130.67 P(f) release ramp

P(f) limitation curve based on Italy MV grid code

This is an example of an *incremental* P(f) limitation.

When *130.63 P(f) corner frequency* is crossed, a timer is started to hold off and keep the P(f) feature inactive for the time set in parameter *130.69 P(f) activation delay*. After the delay time, the P(f) limitation ramp is applied. The gradient of the ramp is determined by parameter *130.64 P(f) limit gradient* and the magnitude of the instantaneous power when the delay time elapsed. The actual power limit, as controlled by the gradient, can only move towards lower values as frequency increases. It stays at its current lowest value as long as the frequency remains above the corner frequency defined in parameter *130.63 P(f) corner frequency*. As the frequency decreases and passes through the corner frequency, a release delay is started. The *130.66 P(f) release time* must elapse before the power limit is ramped up with *130.67 P(f) release ramp* in relation to the nominal power.

Settings

130.62 P(f) limit type

130.63 P(f) corner frequency

130.64 P(f) limit gradient

130.66 P(f) release time
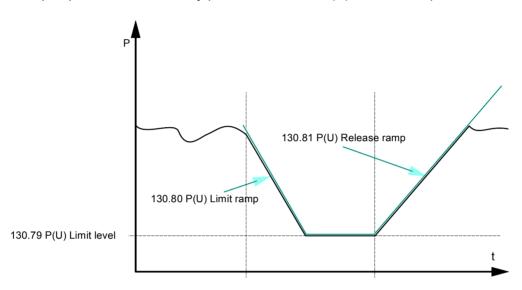
130.67 P(f) release ramp
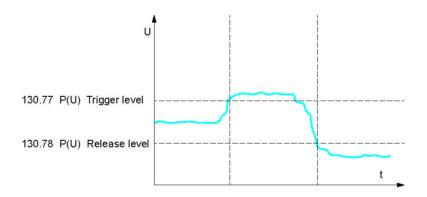
130.69 P(f) activation delay

◼ Limitation based on grid voltage

Active power limit as a function of grid voltage is used to counteract the increase in grid voltage due to active power production. When average grid voltage

- exceeds *130.77 P(U) trigger level*, the power limit is ramped down to *130.79 P(U) limit level*. Parameter *130.80 P(U) limit ramp* defines the slope of the ramp down from the P(U) triggering level.
- falls below the *130.78 P(U) release level*, power limit is released and active power ramps upwards as defined by parameter *130.81 P(U) release ramp*.

Settings

130.77 P(U) trigger level

130.78 P(U) release level

130.79 P(U) limit level

130.80 P(U) limit ramp

130.81 P(U) release ramp

■ Flat-top limit

Normally, the inverter has a power capability shaped like a semi-circle meaning that the inverter can produce as much active power as it can produce reactive power. Enabling the Flat-top limit in the inverter changes the shape of the power capacity to a semi-circle shape with a flat top instead of the normal curved form.
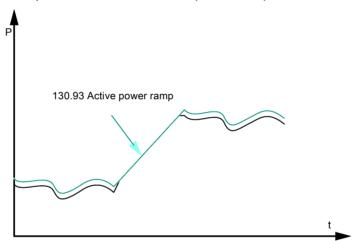
The Flat-top limit applies a new setpoint to the full active power capacity of the inverter. As the Flat-top setpoint is lower than the setpoint for nominal active power and AC current limit is unaffected by Flat-top, it increases the full active power range of the inverter i.e. to the full width of the flat top. Note that Flat-top works just like a constant active power limit.

Settings
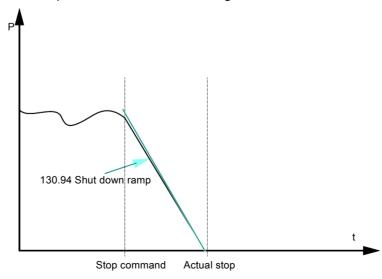
130.90 Flat-top limit

■ Power gradient

The power gradient function limits the rate of rise in active power to a predefined value. This has the effect of stabilizing the grid as the power cannot change too rapidly. The power gradient function can be enabled with parameter *130.92 Active power ramping* and the rate of rise is set with parameter *130.93 Active power ramp*.

A shut down ramp is implemented to achieve smooth shut down when a stop command is received. Power is first reduced slowly to zero before the grid relays are opened. The ramp is defined in parameter *130.94 Shut down ramp*. The shut down ramp is not applied when the grid disconnection takes place because of faults or grid disturbances.

Settings

130.92 Active power ramping

130.93 Active power ramp

130.94 Shut down ramp

189.01 Inverter operation

String monitoring

In the -SX inverter model each individual string current is measured. The measurements are is used to detect reverse string current, blown fuses and deviation in the measured string currents. In the -S inverter model only the total reverse string current can be detected.

◼ Reverse input current detection

If reverse current is detected in the total input current, a fault is activated after a short delay. The threshold value is initially set with parameter *174.31 Reverse input current limit* so that the inverter recognizes the reverse current. Reverse input current detection is enabled/disabled with parameter *174.30 Reverse input current detection*. Reverse current detection is enabled by default.

Settings

174.30 Reverse input current detection

174.31 Reverse input current limit

174.32 Reverse input current delay

101.30 Input current

◼ Reverse string current detection (-SX model)

If reverse current is detected in one of the connected strings, a warning is indicated. The threshold value is initially set in parameter *174.13 Reverse string current limit*, so that it recognizes the reverse current direction. Reverse current detection is enabled with parameter *174.12 Reverse string current detection*.

Settings

174.12 Reverse string current detection

174.13 Reverse string current limit

174.35 Reverse string current threshold

174.36 Reverse string current delay

174.50 Current: [1] -- 174.57 Current: [8]

◼ Blown fuse detection (-SX model)

In the -SX model a warning is indicated to the user in case of a blown fuse. The blown fuse detection is enabled with parameter *174.22 Blown fuse detection*. Blown fuse is detected if the string current is around 0.0 A in an activated string and the average string current is greater than *174.22 Blown fuse detection*.

Settings

174.11 Input connection status

■ **String current deviation detection (-SX model)**

A faulty string, for example, due to high amount of shadowing or obstacles can be detected if the current in one string deviates significantly from other strings. The feature can be enabled with parameter *174.14 String current detection* and it has several configuration parameters.

Inverter can be configured to use either relative or absolute comparison between string currents with parameter *174.16 Comparison mode*. If there is a major difference, a warning is indicated after the delay set in parameter *174.15 String monitor delay*. The value that the individual currents are compared against is the reference value of which type is defined in parameter *174.17 Reference type*. The reference value can be selected to be either the maximum or the mean value of the connected strings.

- In **absolute mode**, individual string currents are compared against the reference value in amperes. If the difference is greater than the value set in parameter *174.19 Absolute current limit* in amperes, a warning is indicated after a delay.

- In **relative comparison mode**, individual string currents are compared against the reference value in percent. The limit is defined in parameter *174.18 Relative current limit*. If a string current is greater or lower than the reference value, a warning is indicated after the delay time is elapsed. In addition, the reference value must be greater than the value defined in parameter *174.20 Relative threshold* to avoid nuisance warnings at very low currents.

Settings

174.11 Input connection status

174.14 String current detection

174.15 String monitor delay

174.16 Comparison mode

174.17 Reference type

174.18 Relative current limit

174.19 Absolute current limit

174.20 Relative threshold

174.50 Current: [1] -- 174.57 Current: [8]

Autoreset

The Autoreset function resets faults automatically without intervention from the user or service staff. However, a fault can be reset automatically only for a predefined number of times before the fault becomes permanent and must be reset manually by the user.

Note: A permanent fault always prevents grid connection.

There are three categories of faults:

Category 1: Faults that are automatically reset and have individual configuration parameters (see page *31*)

Category 2: Faults that are automatically reset and share configuration parameters (see page *32*)

Category 3: Faults that are not automatically reset, i.e. rest of the faults

■ Faults with individual configuration settings (category 1 faults)

These faults have individual configuration parameters for maximum number of fault occurrences and adjustable time period between reset attempts. These faults may also require fine tuning of the autoreset settings due to environmental and installation site conditions.

The table below shows the category 1 faults:

Fault code	Fault name
11776	AC overcurrent
37120	Ground current
37190	DC protection
37191	Isolation

These faults have two parameters,
• one for setting the total number of counts the autoreset function can clear/reset the fault before it becomes permanent.
• one for controlling the time period between consecutive reset attempts.
  Note: When the inverter is connected to the grid for more than 10 seconds, all autoreset counts are reset to zero and allows to restart counting from zero.

The inverter indicates the warning *57652 Autoreset*, when an attempt is made to clear a fault.

For example, the fault *37191 Isolation* can be caused due to moisture build-up on the solar panels during the night. It is not needed here to restart the inverter every minute in the early morning because it may take some time for the moisture to evaporate. In this case, it is better to define a longer time between consecutive autoreset attempts for the isolation fault.

Settings

132.03 Overcurrent trials

132.04 Overcurrent reset delay

132.05 DC protection trials

132.06 DC protection reset delay

132.07 Ground impedance trials

132.08 Ground impedance reset delay

132.09 Ground current trials

132.10 Ground current reset delay

Diagnostics

132.01 Autoreset counter

Warning *57652 Autoreset*

■ **Faults with common configuration settings (category 2 faults)**

These faults have common configuration parameters for maximum number of fault occurrences and adjustable time period between reset attempts. The faults share two parameters:

• one for setting maximum number of fault occurrences and

• one for controlling the time period between reset attempts.

The two parameters are linked to a group of 20 parameters that can be configured to hold one fault code each. All fault codes entered in the parameter group can be cleared with the Autoreset function. The first 11 parameters in the group are predefined with fault codes known to have sometimes caused nuisance tripping of the inverter. The remaining nine parameters can be configured with any fault codes that may be needed by the user to be automatically reset.

The table below shows the category 2 faults:

Fault code	Fault name
15872	Input phase loss
18185	Synchronization fault
24068	PU logic error
24081	Unknown PU fault
28160	FPGA version incompatible
28165	Internal file load
28168	Memory unit detached
28172	Parameter system
32272	Ext I/P comm loss
37123	Grid relay
37130	HW mismatch

Diagnostics

132.02 Autoreset boot counter

Fault history

The inverter fault history is accessed from the **Events** menu or from parameter group *104 Warnings and faults*. In the **Events** menu, active faults and warnings are shown under separate submenus. All faults are shown under one single submenu. Warnings and other events are shown in another submenu. Other events are, for example, faults that are reset by the user or the Autoreset function.

Fault and warning codes can be read through the fieldbus interface. For more information, see chapter *Fieldbus interfaces*.

The fault history is cleared with parameter *196.51 Clear fault and event logger*.

Temperature control

The thermal model of the inverter controls the cooling of the inverter as well as protects it. The thermal model controls the operation and speed of the cooling fans and limits the output current, if needed. Overtemperature warning is indicated if the inverter temperature exceeded the limit and current limitation is activated. If the temperature of the inverter continues to increase, a fault is triggered and the inverter disconnects. The fault has to be reset manually.

Diagnostics

130.04 Limit word 4: bit3 CB temperature, bit4 inverter temperature, bit5 filter temperature

173.06 Internal fan speed

173.07 External fan 1 speed

173.08 External fan 2 speed

173.23 Control board temperature

173.24 Inverter temperature A

173.25 Inverter temperature B

173.26 Inverter temperature C

173.27 Line filter temperature

Fan service

The inverter has three fans that run on a need basis depending on the temperature inside the inverter. The fan speed is variable and controlled by the software. The lifetime of the fans depends on the installation and the internal temperature of the inverter. A typical replacement time for the fans is eight years.

The inverter indicates a warning when the fan run time counter is near the calculated life time. After the run time counter warning, the inverter and fans continue their normal operation, but the fans must be replaced with new ones to guarantee optimal operation of the inverter.

The inverter indicates a warning if the fans are not running when they should be. In that case the inverter continues operation but may limit the output power or may trip due to overtemperature.

■ Resetting fan run time counters
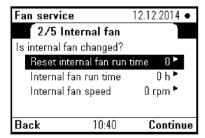
See *PRO-33.0-TL Product manual* (3AUA0000123261 [English]), for information on how to replace the fans. Note that the inverter must be stopped and disconnected from the grid when the fans are replaced.

After replacing the fans, reset the fan run time counters according to the below procedure. Do not reset the counters after only cleaning the fans.

1. Enter the **Service** menu, select **Assistants** and **Fan Service**.

    Fan service assistant info is shown.

2. Press **Continue** to proceed.

    ```
    ┌──────────────────────────────┐
    │ Fan service      12.12.2014 ● │
    │ ┌─1/5 Fan service info─────┐ │
    │ Fan service assistant helps you to │
    │ check fan status and reset run time │
    │ counters after replacing old fans. │
    │ Press Continue to check fan status. │
    │                              │
    │                              │
    │ Exit        10:39   Continue │
    └──────────────────────────────┘
    ```
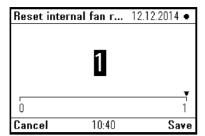
3. Change between different fans (Internal fan, External fan 1, External fan 2) menus with **Back** and **Continue**.

    ```
    ┌──────────────────────────────┐
    │ Fan service      12.12.2014 ● │
    │ ┌─2/5 Internal fan─────────┐ │
    │ Is internal fan changed?    │
    │ │Reset internal fan run time  0▶│ │
    │  Internal fan run time   0 h ▶ │
    │  Internal fan speed    0 rpm ▶ │
    │                              │
    │ Back        10:40   Continue │
    └──────────────────────────────┘
    ```

4. Reset the counters of the fans that were changed by pressing the right arrow key and setting the value to **1**.

5. Press **Save** to save the selection.

6. Press OK to confirm that you have completed the Fan service assistant and return to the menu.

Diagnostics

173.03 Internal fan run time

173.04 External fan 1 run time

173.05 External fan 2 run time

173.06 Internal fan speed

173.07 External fan 1 speed

173.07 External fan 2 speed

3

Parameters

Contents of this chapter

The chapter describes the inverter parameters. The parameters are either editable or read-only. The parameters can be used to change inverter settings and are saved periodically to permanent memory.

The read-only parameters (actual values) can be used to view the inverter status. An actual value is the result of a measurement or calculation by the inverter, or it contains status information.

Compatibility

The parameters described in this section are compatible with firmware version KLUF0 v1.72.

Earlier firmware releases does not support all parameters described in this document. If a parameter is not visible when using the control unit or the Drive composer configuration tool, then that particular parameter or feature is not supported in the firmware version that the inverter is currently running.

Reading the parameter listing table

In the parameter listing section, each configuration parameter and its properties are described. The rows and columns of the parameter listing and how to interpret them are explained below in *italicized* text.

Example header of the parameter listing table.

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
Parameter group and index	*Parameter name, value/range and unit*	*Parameter description*	*Default value and* *Fieldbus equivalent for 16-bit and 32-bit access.*

Example parameter indexes: Interpretation of data in the table.

101 Actual values		
Parameter group index and name.		
101.01 *Parameter group and index.*	DC voltage *Parameter name*	Measured DC link voltage. *Brief description of parameter and what it does.*	- *A dash "-" indicates that default value is not applicable.*
	0 … 2 000 V *Value range and unit.*		10 = 1 V / 100 = 1 V *10 = 1 V means 16-bit access with one decimal.* *100 = 1 V means 32-bit access with two decimals.*
			- / 1000 = 1 Mohm *A dash "-" means 16-bit access is not possible.* *1000 = 1 Mohm means 32-bit access only, with three decimals.*
			1 = 1 mA *16-bit and 32-bit access are identical, integers only.*
158.04	Baud rate *For parameters with a set of fixed selection options, the values are listed in below rows.*	Selects the communication speed of... *For parameters with selection options, each option is briefly described in below rows.*	19.2 kbps *Default selection* *For parameters with fixed selection options the fieldbus values are fixed integers as listed in below rows.*
	Autodetect	Automatic baud rate detection.	0
	9.6 kbps	Force baud rate to 9 600 bps.	1
	19.2 kbps	Force baud rate to 19 200 bps.	2
	38.4 kbps	Force baud rate to 38 400 bps.	3
	57.6 kbps	Force baud rate to 57 600 bps.	4
	76.8 kbps	Force baud rate to 76 800 bps.	5
	115.2 kbps	Force baud rate to 115 200 bps.	6

Parameter listing

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
101 Actual values			
101.01	DC voltage	Measured DC link voltage.	-
	0 … 2 000 V		10 = 1 V / 100 = 1 V
101.02	Line current	Calculated line current.	-
	0 … 100 A		10 = 1 A / 100 = 1 A
101.03	Line current %	Calculated line current in percent of the nominal current.	-
	0 … 200%		1 = 1% / 10 = 1%
101.04	Active current	Calculated active current.	-
	0 … 100		10 = 1 A / 100 = 1 A
101.05	Active current%	Active current in percent of the nominal current.	-
	0 … 200%		1 = 1% / 10 = 1%
101.06	Reactive current	Calculated reactive current.	-
	-100 … 100		10 = 1 A / 100 = 1 A
101.07	Reactive current %	Reactive current in percent of the nominal current.	-
	-200 … 200%		1 = 1% / 10 = 1%
101.08	Frequency	Measured grid frequency.	-
	0 … 100 Hz		100 = 1 Hz
101.09	Grid voltage	Calculated average line-to-line grid voltage based on voltage measurements.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V
101.10	Apparent power	Apparent output power of the inverter.	-
	0 … 50		10 = 1 kVA
101.11	Apparent power %	Apparent output power of the inverter in percent of the nominal output power.	-
	0 … 200%		1 = 1% / 10 = 1%
101.12	Power	Calculated output power.	-
	0 … 50		10 = 1 kW
101.13	Power %	Output power in percent of the nominal power.	-
	0 … 200%		1 = 1% / 10 = 1%
101.14	Reactive power	Calculated reactive output power.	-
	-100 … 100		10 = 1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
101.15	Reactive power %	Calculated reactive output power in percent of the nominal power.	-
	-200 … 200%		1 = 1% / 10 = 1%
101.16	CosPhi	Power factor.	-
	-1 … 1		100 = 1
101.20	Converter current	Measured converter current.	-
	0 … 100		10 = 1 A / 100 = 1 A
101.21	Converter current %	Measured converter current in percent of the nominal current.	-
	0 … 200%		1 = 1% / 10 = 1%
101.30	Input current	Measured input current	-
	0 … 100 A		10 = 1 A / 100 = 1 A

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
104 Warnings and faults			
104.01	Tripping fault	Fault which actually caused the inverter to trip, as it arrived at the trip register.	- 1 = 1
104.02	Active fault 2	2nd active fault in the trip register.	- 1 = 1
104.03	Active fault 3	3rd active fault in the trip register.	- 1 = 1
104.04	Active fault 4	4th active fault in the trip register.	- 1 = 1
104.05	Active fault 5	5th active fault in the trip register.	- 1 = 1
104.06	Active warning 1	1st active warning in the warning register.	- 1 = 1
104.07	Active warning 2	2nd active warning in the warning register.	- 1 = 1
104.08	Active warning 3	3rd active warning in the warning register.	- 1 = 1
104.09	Active warning 4	4th active warning in the warning register.	- 1 = 1
104.10	Active warning 5	5th active warning in the warning register.	- 1 = 1
104.11	Latest fault	Latest fault in the trip log store. The trip log store is loaded with the active faults in the order they occur.	- 1 = 1
104.12	2nd latest fault	2nd fault in the trip log store.	- 1 = 1
104.13	3rd latest fault	3rd fault in the trip log store.	- 1 = 1
104.14	4th latest fault	4th fault in the trip log store.	- 1 = 1
104.15	5th latest fault	5th fault in the trip log store.	- 1 = 1
104.16	Latest warning	Latest warning in the warning log store. The warning log store is loaded with the active warnings in the order they occur.	- 1 = 1
104.17	2nd latest warning	2nd warning in the trip log store.	- 1 = 1
104.18	3rd latest warning	3rd warning in the trip log store.	- 1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
104.19	4th latest warning	4th warning in the trip log store.	-
			1 = 1
104.20	5th latest warning	5th warning in the trip log store.	-
			1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
107 System info			
107.04	Firmware name	Shows the inverter firmware name.	- / 1 = 1
107.05	Firmware version	Shows the inverter firmware version.	- / 1 = 1
107.06	Loading package name	Shows the inverter loading package name.	- / 1 = 1
107.07	Loading package version	Shows the inverter loading package version.	- / 1 = 1
107.20	LCON HW version	Shows the HW version of the LCON board.	-
	0 … 255		1 = 1
107.21	LUAC HW version	Shows the HW version of the LUAC board.	-
	0 … 255		1 = 1
107.22	LUFU HW version	Shows the HW version of the LUFU board.	-
	0 … 255		1 = 1
107.23	LUPU HW version	Shows the HW version of the LUPU board.	-
	0 … 255		1 = 1
107.30	Product name1	Holds part of the Product Name of the inverter. The Product Name is obtained by concatenating parameters "Product name1" ... "Product name6" into a string. Each parameter contains 4 ASCII characters represented as a 32 decimal number.	0
	-		- / 1 = 1
...	...	...	...
107.36	Product name7	See parameter *107.30 Product name1*	- / 1 = 1
107.40	Product serial number1	Holds part of the serial number of the inverter. The serial number is obtained by concatenating parameters "Product serial number1" ... "Product serial number6" into a string. Each parameter contains 4 ASCII characters represented as a 32 decimal number.	0
	-		- / 1 = 1
...	...	...	...
107.46	Product serial number7	See parameter *107.40 Product serial number1*	0
	-		- / 1 = 1
107.50	CB serial number1	Holds part of the control board serial number of the inverter. The complete serial number is obtained by concatenating all the "CB serial number" parameters into a string. Each parameter contains 4 ASCII characters represented as a 32 decimal number. Characters are arranged from left to right in the 32 bit integer.	0
	-		- / 1 = 1
...	...	...	...
107.56	CB serial number7	See parameter *107.50 CB serial number1*	- / 1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
114 Extension I/O module 1			
114.01	Option module 1 type	Activates and specifies the type of I/O extension module 1.	None
	None	None	0
	FIO-01	FIO-01	1
	FIO-11	FIO-11	2
114.03	Option module 1 status	Displays the status of I/O extension module 1.	No option
	No option	No module detected in the specified slot.	0
	No communication	A module has been detected but cannot be communicated with.	1
	Unknown	The module type is unknown.	2
	FIO-01	An FIO-01 module has been detected and is active.	15
	FIO-11	An FIO-11 module has been detected and is active.	20
114.05	DIO status	(*Visible ony when parameter 114.01 Option module 1 type is FIO-01 or FIO-11.*) Displays the status of the digital input/outputs on the extension module. The activation/ deactivation delays (if any are specified) are ignored. Bit 0 indicates the status of DIO1. **Note**: The number of active bits in this parameter depends on the number of digital input/outputs on the extension module. **Example**: 00001001b = DIO1 and DIO4 are on, remainder are off. This parameter is read-only.	- 1 = 1
114.09	DIO1 configuration	(*Visible only when parameter 114.01 Option module 1 type is FIO-01 or FIO-11.*) Selects whether DIO1 of the extension module is used as a digital input or output.	Input
	Output	DIO1 is used as a digital output.	0
	Input	DIO1 is used as a digital input.	1
114.11	DIO1 output source	(*Visible only when parameter 114.01 Option module 1 type is FIO-01 or FIO-11.*) Selects an inverter signal to be connected to digital input/output DIO1 of the extension module when parameter 114.09 DIO1 configuration is set to Output.	Off
	Off		0
	Always On		1
	Fault	Relay output activation when fault.	2
	No fault	Relay output activation when no fault.	3
	Grid connected	Relay output activation when grid connected.	4
	Grid not connected	Relay output activation when grid not connected.	5
	Power level 20%	Relay output activation when output power level over 20% of rated power.	6
	Power level 40%	Relay output activation when output power level over 40% of rated power.	7

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
	Power level 70%	Relay output activation when output power level over 70% of rated power.	8
114.14	DIO2 configuration	(*Visible only when parameter 114.01 Option module 1 type is FIO-01 or FIO-11.*) Selects whether DIO2 of the extension module is used as a digital input or output.	Input
	Output	DIO2 is used as a digital output.	0
	Input	DIO2 is used as a digital input.	1
114.16	DIO2 output source	(*Visible only when parameter 114.01 Option module 1 type is FIO-01 or FIO-11.*) Selects an inverter signal to be connected to digital input/output DIO2 of the extension module when parameter 114.14 DIO2 configuration is set to Output. For the available selections, see parameter 114.11 DIO1 output source.	Off
114.19	DIO3 configuration	(*Visible only when parameter 114.01 Option module 1 type is FIO-01.*) Selects whether DIO3 of the extension module is used as a digital input or output.	No action
	Output	DIO3 is used as a digital output.	0
	Input	DIO3 is used as a digital input.	1
114.21	DIO3 output source	(*Visible onlt when parameter 114.01 Option module 1 type is FIO-01.*) Selects an inverter signal to be connected to digital input/output DIO3 of the extension module when parameter 114.19 DIO3 configuration is set to Output. For the available selections, see parameter 114.11 DIO1 output source.	Off
114.24	DIO4 configuration	(*Visible only when parameter 114.01 Option module 1 type is FIO-01.*) Selects whether DIO4 of the extension module is used as a digital input or output.	Input
	Output	DIO4 is used as a digital output.	0
	Input	DIO4 is used as a digital input.	1
114.26	DIO4 output source	(*Visible only when parameter 114.01 Option module 1 type is FIO-01.*) Selects an inverter signal to be connected to digital input/output DIO4 of the extension module when parameter 114.24 DIO4 configuration is set to Output. For the available selections, see parameter 114.11 DIO1 output source.	Off
114.26	AI1 actual value	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Displays the value of analog input AI1 in mA or V (depending on whether the input is set to current or voltage). This parameter is read-only.	-

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
114.27	AI1 scaled value	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Displays the value of analog input AI1 after scaling. See parameter *114.35 AI1 scaled at AI1 min*. This parameter is read-only.	-
114.29	AI1 HW switch position	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Shows the position of the hardware current/voltage selector on the I/O extension module. **Note**: The setting of the current/voltage selector must match the unit selection made in parameter *114.30 AI1 unit selection*.	mA
	mA	milliamperes	0
	V	voltage	1
114.30	AI1 unit selection	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Selects the unit for readings and settings related to analog input AI1. **Note**: This setting must match the corresponding hardware setting on the I/O extension module (see the manual of the I/O extension module). The hardware setting is shown by parameter *114.29 AI1 HW switch position*.	mA
	mA	milliamperes	0
	V	voltage	1
114.31	RO status	(*Visible only when parameter 114.01 Option module 1 type is FIO-01.*) Status of relay outputs on the I/O extension module. Example: 00000001b = RO1 is energized, RO2 is de-energized.	-
	0000h…FFFFh	Status of relay outputs	1 = 1
114.33	AI1 min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Defines the minimum value for analog input AI1.	0.000 mA or V
	-22.000 … 22.000 mA or V	Minimum value of AI1.	1000 = 1 mA or V
114.34	RO1 source	(*Visible only when parameter 114.01 Option module 1 type is FIO-01.*) Selects an inverter signal to be connected to relay output RO1. For the available selections, see parameter *114.11 DIO1 output source*.	Off
114.34	AI1 max	(*Visible only when parameter 114.01 Option module 1 type is FIO-01 or FIO-11.*) Defines the maximum value for analog input AI1.	10.000 mA or V
	-22.000 … 22.000 mA or V	Maximum value of AI1.	1000 = 1 mA or V

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
114.35	AI1 scaled at AI1 min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	0.0000
		Defines the real value that corresponds to the minimum analog input AI1 value defined by parameter *114.33 AI1 min*.	
	-32768.000 … 32767.000	Real value corresponding to minimum AI1 value.	1 = 1
114.36	AI1 scaled at AI1 max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	100.000
		Defines the real value that corresponds to the maximum analog input AI1 value defined by parameter *114.34 AI1 max*. See the drawing at parameter *114.35 AI1 scaled at AI1 min*.	
	-32768.000 … 32767.000	Real value corresponding to maximum AI1 value.	1 = 1
114.37	RO2 source	(*Visible only when parameter 114.01 Option module 1 type is FIO-01.*)	Off
		Selects an inverter signal to be connected to relay output RO2. For the available selections, see parameter *114.11 DIO1 output source*.	
114.41	AI2 actual value	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	-
		Displays the value of analog input AI2 in mA or V (depending on whether the input is set to current or voltage). This parameter is read-only.	
	-22.000 … 22.000 mA or V	Value of analog input AI2.	1000 = 1 mA or V
114.42	AI2 scaled value	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	-
		Displays the value of analog input AI2 after scaling. See parameter *114.50 AI2 scaled at AI2 min*. This parameter is read-only.	
	-32768.000 … 32767.000	Scaled value of analog input AI2.	1 = 1
114.44	AI2 HW switch pos	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	-
		Shows the position of the hardware current/voltage selector on the I/O extension module.	
		Note: The setting of the current/voltage selector must match the unit selection made in parameter *114.45 AI2 unit selection*.	
	V	Volts	2
	mA	Milliamperes	10

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
114.45	AI2 unit selection	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	mA
		Selects the unit for readings and settings related to analog input AI2.	
		Note: This setting must match the corresponding hardware setting on the I/O extension module (see the manual of the I/O extension module). The hardware setting is shown by parameter *114.44 AI2 HW switch pos*.	
	V	Volts	2
	mA	Milliamperes	10
114.48	AI2 min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	0.000 mA or V
		Defines the minimum value for analog input AI2.	
	-22.000 .. 22.000 mA or V	Minimum value of AI2.	1000 = 1 mA or V
114.49	AI2 max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	10.000 mA or V
		Defines the maximum value for analog input AI2	
	-22.000 … 22.000 mA or V	Maximum value of AI2.	1000 = 1 mA or V
114.50	AI2 scaled at AI2 min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	0.000
		Defines the real value that corresponds to the minimum analog input AI2 value defined by parameter *114.48 AI2 min*.	
	-32768.000 … 32767.000	Real value corresponding to minimum AI2 value.	1 = 1
114.51	AI2 scaled at AI2 max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	100.000
		Defines the real value that corresponds to the maximum analog input AI2 value defined by parameter *114.49 AI2 max*. See the drawing at parameter *114.50 AI2 scaled at AI2 min*.	
	-32768.000 … 32767.000	Real value corresponding to maximum AI2 value.	1 = 1
114.56	AI3 actual value	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	-
		Displays the value of analog input AI3 in mA or V (depending on whether the input is set to current or voltage). This parameter is read-only.	
	-22.000 … 22.000 mA or V	Value of analog input AI3.	1000 = 1 mA or V
114.57	AI3 scaled value	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	-
		Displays the value of analog input AI3 after scaling. See parameter *114.65 AI3 scaled at AI3 min*. This parameter is read-only.	
	-32768.000 … 32767.000	Scaled value of analog input AI3.	1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
114.59	AI3 HW switch position	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	-
		Shows the position of the hardware current/voltage selector on the I/O extension module.	
		Note: The setting of the current/voltage selector must match the unit selection made in parameter *114.60 AI3 unit selection*.	
	V	Volts	2
	mA	Milliamperes	10
114.60	AI3 unit selection	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	mA
		Selects the unit for readings and settings related to analog input AI3.	
		Note: This setting must match the corresponding hardware setting on the I/O extension module (see the manual of the I/O extension module). The hardware setting is shown by parameter *114.59 AI3 HW switch position*.	
	V	Volts	2
	mA	Milliamperes	10
114.63	AI3 min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	0.000 mA or V
		Defines the minimum value for analog input AI3.	
	-22.000 … 22.000 mA or V	Minimum value of AI3.	1000 = 1 mA or V
114.64	AI3 max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	10
		Defines the maximum value for analog input AI3.	
	-22.000 … 22.000 mA or V	Maximum value of AI3.	1000 = 1 mA or V
114.65	AI3 scaled at AI3 min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	0.000
		Defines the real value that corresponds to the minimum analog input AI3 value defined by parameter *114.63 AI3 min*.	
	-32768.000 … 32767.000	Real value corresponding to minimum AI3 value.	1 = 1
114.66	AI3 scaled at AI3 max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*)	100.000
		Defines the real value that corresponds to the maximum analog input AI3 value defined by parameter *114.64 AI3 max*. See the drawing at parameter *114.65 AI3 scaled at AI3 min*.	
	-32768.000 … 32767.000	Real value corresponding to maximum AI3 value.	1 = 1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
114.76	AO1 actual	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Displays the value of AO1 in mA. This parameter is read-only.	-
	0.000 ... 22.000 mA	Value of AO1.	1000 = 1 mA
114.77	AO1 source	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Selects a signal to be connected to analog output AO1.	Zero
	Zero		0
	DC voltage	*101.01 DC voltage*	1
	Line current	*101.02 Line current*	2
	Power	*101.12 Power*	3
	Frequency	*101.08 Frequency*	4
	Temperature sensor excitation	*117.12 PT sensor current actual*	5
	Inverter temperature A	*173.24 Inverter temperature A*	6
	Inverter temperature B	*173.25 Inverter temperature B*	7
	Inverter temperature C	*173.26 Inverter temperature C*	8
114.80	AO1 source min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Defines the real value of the signal (selected by parameter *114.77 AO1 source*) that corresponds to the minimum AO1 output value (defined by parameter *114.82 AO1 out at AO1 src min*).	0.0
	-32768.0 … 32767.0	Real signal value corresponding to minimum AO1 output value.	1 = 1
114.81	AO1 source max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Defines the real value of the signal (selected by parameter 114.77 AO1 source) that corresponds to the maximum AO1 output value (defined by parameter *114.83 AO1 out at AO1 src max*). See parameter *114.80 AO1 source min*.	100.0
	-32768.0 … 32767.0	Real signal value corresponding to maximum AO1 output value.	1 = 1
114.82	AO1 out at AO1 src min	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Defines the minimum output value for analog output AO1. See also drawing at parameter *114.80 AO1 source min*.	0.000 mA
	0.000 … 22.000 mA	Minimum AO1 output value.	1000 = 1 mA
114.83	AO1 out at AO1 src max	(*Visible only when parameter 114.01 Option module 1 type is FIO-11.*) Defines the maximum output value for analog output AO1. See also drawing at parameter *114.80 AO1 source min*.	10.000 mA
	0.000 … 22.000 mA		1000 = 1 mA

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
117 External sensors			
117.01	PT sensor temperature	Shows the external temperature measured by PT sensor.	-
	-50...100		10=1 °C
117.02	Temperature 2	Shows the external temperature 2.	-
	-50...100		10=1 °C
117.05	Irradiation 1	Shows the irradiation 1.	-
	0...1500		1 = 1 W/m^2
117.06	Irradiation 2	Shows the irradiation 2.	-
	0...1500		1 = 1 W/m^2
117.10	PT sensor type	Sets the used PT temperature sensor.	-
	None		0
	PT100		1
	PT1000		2
117.11	PT sensor current amplitude	Sets the current that is fed to temperature sensor when measurement is done.	18 mA
	0...20 mA		10 = 1 mA
117.12	PT sensor current actual	Shows the actual pulsed current that is fed to temperature sensor. This parameter can be pointed by source parameter for analog output. Pulsing is used to avoid heating the sensor.	-
	0...20 mA		10 = 1 mA
117.13	PT sensor input	Sets from which input PT sensor temperature signal is read.	-
	None	0.	0
	AI1	*114.26 AI1 actual value* (page *45*)	1
	AI2	*114.41 AI2 actual value* (page *47*)	2
	AI3	*114.56 AI3 actual value* (page *48*)	3
117.14	Temperature 2 input	Sets from which input temperature signal is read.	-
	None	0.	0
	AI1	*114.26 AI1 actual value* (page *45*)	1
	AI2	*114.41 AI2 actual value* (page *47*)	2
	AI3	*114.56 AI3 actual value* (page *48*)	3
117.15	Irradiation 1 input	Sets from which input irradiation signal is read.	-
	None	0.	0
	AI1	*114.26 AI1 actual value* (page *45*)	1
	AI2	*114.41 AI2 actual value* (page *47*)	2
	AI3	*114.56 AI3 actual value* (page *48*)	3
117.16	Irradiation 2 input	Sets from which input irradiation signal is read.	-
	None	0.	0
	AI1	*114.26 AI1 actual value* (page *45*)	1
	AI2	*114.41 AI2 actual value* (page *47*)	2
	AI3	*114.56 AI3 actual value* (page *48*)	3

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
124 Q ref			
124.01	User Qref	Writes the reactive reference value. The value unit depends on *124.06 Q power ref type*.	-
	-		1 = 1 / 100 = 1
124.06	Q power ref type	Sets the reactive power reference type.	Qref [%]
	Ireact ref [A]	Reactive current reference.	0
	Ireact ref [%]	Reactive current reference in percent.	1
	Qref [kVAr]	Reactive power reference.	2
	Qref [%]	Reactive power reference in percents of nominal power.	3
	Phi	Reactive power reference expressed as phase angle in degrees.	4
	CosPhi	Reactive power reference expressed as cosinus phi i.e. power factor.	5
	Q(x) regulation curve	Q(x) regulation curve. See parameter *124.30 Q(x) curve*.	8
124.11	Ireact ref max %	Maximum value of reactive current reference in percent.	105%
	0 … 200%		1 = 1% / 10 = 1%
124.12	Ireact ref min %	Minimum value of reactive current reference in percent.	-105%
	-200 … 0%		1 = 1% / 10 = 1%
124.13	Ireact ref lim %	Output value of reactive power reference limitation. Limitation based on *124.11 Ireact ref max %* and *124.12 Ireact ref min %* values.	-
	-200 … 200%		1 = 1% / 10 = 1%
124.14	Ireact ref ramp up	Reactive current ramp up time in ms.	1000 ms
	0 … 30000 ms		1 = 1 ms
124.15	Ireact ref ramp down	Reactive current ramp down time in ms.	1000 ms
	0 … 30000 ms		1 = 1 ms
124.16	Ireact ref out %	Output value of reactive current reference in percent.	-
	-200 … 200%		1 = 1% / 10 = 1%
124.17	Ireact ref out	Output value of reactive current in amperes.	-
	-		1 = 1 A / 100 = 1 A
124.18	Q pow ref out %	Output value of reactive power reference in percents of nominal power.	-
	-200 … 200%		1 = 1% / 10 = 1%
124.19	Q pow ref out	Output value of reactive power reference in kVArs.	-

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
	-		1 = 1 / 10 = 1
124.30	Q(x) curve	Selects the input signal used in Q(x) regulation curve.	-
	Q(U)	Input: Measured grid voltage Output: Reactive power reference	0
	Q(P)	Input: Actual active power Output: Reactive power reference	1
	CosPhi(P)	Input: Actual active power Output: CosPhi	2
124.31	Lock-in level	Defines the lock-in level to activate the Q(x) regulation curve.	20%
	0 … 200%		1 = 1%
124.32	Lock-out level	Defines the lock-out level to deactivate the Q(x) regulation curve.	5%
	0 … 200%		1 = 1%
124.33	Q(x) input level 1	Defines the first input value for the Q(x) regulation curve. When the selected input signal reaches this value, reactive power reference is set to the value defined by parameter *124.39 Q(x) output level 1*.	0%
	-		1 = 1% / 100 = 1%
...	...	...	...
124.38	Q(x) input level 6	See parameter *124.33 Q(x) input level 1*.	
124.39	Q(x) output level 1	Defines the first reference output value for the Q(x) regulation curve. When the selected input signal reaches *124.33 Q(x) input level 1*, the reactive power reference is set to the value defined by this parameter.	0
	-		1 = 1 / 100 = 1
...	...	...	...
124.44	Q(x) output level 6	See parameter *124.39 Q(x) output level 1*	
124.45	Q(U) activation delay	Defines the activation delay for Q(U) curve.	0 ms
	0...30000 ms	Time	1 = 1 ms
124.46	Q(U) activation level low	Defines the lower activation level for Q(U) curve.	100%
	0...200%	Activation level	1 = 1%
124.47	Q(U) activation level high	Defines the higher activation level for Q(U) curve.	100%
	0...200%	Activation level	1 = 1%

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
130 Limits			
130.01	Limit word 1	Shows active power limitation status.	-
	b0...b1: Reserved	Reserved	
	b2: P max	Maximum power level	
	b3: P min	Minimum power level	
	b4: Reserved	Reserved	
	b5: Power gradient	Power gradient	
	b6: Stop ramp	Stop ramp	
	b7: P(f)	P(f) limitation	
	b8: Grid fault	Power is limited after grid fault.	
	b9: Connect	Power is limited after connection to grid.	
	b10: External	External limit is active, *130.75 External power limit*.	
	b11: FRT recovery	Power is limited after FRT event.	
	b12: P(U)	P(U) limitation	
	b13: Flat-top	Flat-top	
	b14: Input current	Input current	
	b15: Grid current	Grid current is limiting active power.	
130.02	Limit word 2	Shows reactive power limitation status.	-
	b0: Q ref max	Reactive power reference is limited by *124.11 Ireact ref max %*.	
	b1: Q ref min	Reactive power reference is limited by *124.12 Ireact ref min %*.	
	b2...b14: Reserved	Reserved	
	b15: Current	Grid current is limiting reactive power.	
130.04	Limit word 4	Shows current based limitation status.	-
	b0...b1: Reserved	Reserved	
	b2: I max	Maximum current	
	b3: CB temperature	Control board temperature	
	b4: Inverter temperature	IGBT temperature	
	b5: Filter temperature	Line filter temperature	
	b6: Nominal power	Nominal apparent power	
	b7...b15: Reserved	Reserved	
130.62	P(f) limit type	Selects the P(f) limiter type.	Disabled
	Disabled	P(f) limiter is disabled.	0
	Free running	Limit moves both ways along the gradient.	1
	Incremental	Limit only decreases along the gradient until the frequency drops below the corner point	2
130.63	P(f) corner frequency	Sets the starting point for limitation.	50.2 Hz
	40 … 70 Hz		100 = 1 Hz
130.64	P(f) limit gradient	Sets the limit gradient.	40%/Hz
	0 … 200%/Hz		10 = 1%/Hz
130.65	P(f) release frequency	Sets the frequency where the power limit is released and ramping the limit up starts.	50.2 Hz
	40 … 70 Hz		100 = 1 Hz

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
130.66	P(f) release time	Sets the waiting time before releasing the power limit. The timer is started after the frequency drops below the release frequency.	0 s
	0 … 600 s		1 = 1 s
130.67	P(f) release ramp	Sets the ramp that is used after releasing the power limit.	10%/min
	0 … 600%/min		1 = 1%/min
130.68	P(f) release ramp ref	Sets the P(f) limiter's release ramp reference.	Nominal
	Nominal	Ramp reference is relative to nominal power.	1
	Corner power	Ramp reference is relative to corner power.	2
	Pdelta	Ramp reference is relative to corner power minus release power.	3
130.69	P(f) activation delay	Sets the waiting time before the Active power limitation function is activated. **Note**: Default setting is 0 ms except for Italy when 3000 ms is used.	0 ms
	0...5000 ms	Time	1 = 1 ms
130.70	Connect limit type	Selects the active power ramping type after connecting to grid.	Off
	Off	No active power ramping after grid connection.	0
	After grid fault	Power ramping is active only after grid fault.	1
	Always	Power ramping is active always when connecting to grid.	2
130.71	Connect limit ramp	Sets the active power ramp that is used after connecting to grid.	10%/min
	0 … 600%/min		1 = 1%/min
130.72	Grid fault ramp	Sets the ramp that is used in reconnection after grid fault.	10%/min
	0 … 600%/min	Ramp value.	1 = 1%/min
130.75	External power limit	Sets the active power limit. Parameter for externally controlled power limit.	200%
	0 … 200%		1 = 1%
130.76	P(U) limiter	Activates P(U) limitation function.	Disable
	Disable		0
	Enable		1
130.77	P(U) trigger level	Sets the voltage level where power limitation is triggered.	110%
	0 … 200%		1 = 1%
130.78	P(U) release level	Sets the voltage level where power limitation is released.	110%
	0 … 200%		1 = 1%
130.79	P(U) limit level	Sets the limited power level.	20%
	0 … 100%		1 = 1%
130.80	P(U) limit ramp	Sets the ramp down after power limit triggering.	50%/min
	0 … 100%/min		1 = 1%/min

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
130.81	P(U) release ramp	Sets the ramp up after power limit release.	20%/min
	0 … 100%/min		1 = 1%/min
130.90	Flat-top limit	Sets the active power limit which cuts the semi-circular operating range to a flat-top range.	200%
	0 … 200%		1 = 1%
130.92	Active power ramping	Enables the active power ramping function.	Disable
	Disable		0
	Enable		1
130.93	Active power ramp	Sets the active power ramp rate.	100%/min
	0 … 1000%/min		1 = 1%/min
130.94	Shut down ramp	Sets the active power ramp that is applied in a controlled shut down.	100%/s
	0 … 1000%/s		1 = 1%/s
130.98	External limit ramp up	Sets the ramp up time for *130.75 External power limit*.	0 ms
	0 … 60 000 ms		1 = 1 ms
130.99	External limit ramp down	Sets the ramp down time for *130.75 External power limit*.	0 ms
	0 … 60 000 ms		1 = 1 ms

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
132 Autoreset			
132.01	Autoreset counter	Shows the number of autoresets. Can be cleared to allow better monitoring.	0
	-		1 = 1
132.02	Autoreset boot counter	Counts the number of forced reboots. Some faults can be reset / cleared only with a firmware reboot. The counter increments when the Autoreset function orders a reboot.	0
	-		- / 1 = 1
132.03	Overcurrent trials	Sets the number of overcurrent autoreset trials.	5
	0 … 20		1 = 1
132.04	Overcurrent reset delay	Sets the delay for overcurrent autoreset.	10 s
	1 … 3000 s		1 = 1 s
132.05	DC protection trials	Number of DC protection autoreset trials.	3
	0 … 20		1 = 1
132.06	DC protection reset delay	Sets the delay for DC protection autoreset.	10 s
	1 … 3000 s		1 = 1 s
132.07	Ground impedance trials	Sets the number of ground impedance autoreset trials.	50
	0 … 100		1 = 1
132.08	Ground impedance reset delay	Sets the delay for ground impedance autoreset.	900 s
	1 … 7200 s		1 = 1 s
132.09	Ground current trials	Sets the number of ground current autoreset trials.	-
	0 … 100		1 = 1
132.10	Ground current reset delay	Sets the delay for ground current autoreset.	-
	1 … 7200 s		1 = 1 s

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
149 Control unit communication			
149.01	Control unit node ID	Unique node identification in the communication network.	2
	1 … 32		1 = 1
149.03	Control unit baud rate	Maximum communication baud rate for the inverter. Reliability of the communication may require lower setting, depending on the electrical characteristics of the wiring.	115.2 kbps
	Reserved	-	0
	38.4 kbps	38.4 kbps	1
	57.6 kbps	57.6 kbps	2
	86.4 kbps	86.4 kbps	3
	115.2 kbps	115.2 kbps	4
	230.4 kbps	230.4 kbps	5
149.06	Refresh settings	Applies settings from parameters *149.01*, *149.03*, *149.20*, *149.21*, *149.23* and *149.24*. **Note**: Changing the settings will cause a communication break. The control unit reconnects automatically, but other bus masters may need to be reconnected manually.	Done
	Done	Refresh done.	0
	Configure	Refresh parameters *149.01* and *149.03*. The value reverts automatically to Done.	1
149.20	Terminal X1, X8	Shows currently active protocol on terminals X1 and X8. **Note**: Terminals X1 and X8 are internally connected and share the same UART. Terminal X1 is intended for connecting the remote PVS-AP-L control unit. This parameter is read only.	Control unit
	Control unit		0
	Modbus RTU		1
	Control unit#2		2
149.21	Terminal X2	Selects the active protocol on terminal X2.	Modbus RTU
	Modbus RTU		0
	Control unit	Swaps the protocols such that the protocol on terminal X2 moves to terminals X1 and X8, and the control unit protocol becomes active on terminal X2. **Note**: • This is a volatile setting, meaning, the setting reverts back to the control unit protocol on terminals X1 and X8 whenever the inverter is power cycled. • Enabling the control unit protocol on terminal X2 also enables firmware update over terminal X2.	1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
	Control unit#2	Enables secondary control unit protocol on terminal X2 which can be used for monitoring purposes using the ABB Drive composer tool. **Note**: Firmware update is not possible using the secondary control unit protocol.	2
149.23	Control unit#2 note ID	(*Visible only when parameter 149.21 = Control unit #2*). Sets the node ID for secondary control unit protocol when activated on terminal X2. When the secondary control unit protocol is activated, it is assigned a node ID equal to the Modbus RTU ID. This allows to retain any network topology already present / defined for RS-485 communication bus.	1
	1 ... 32		1 = 1
149.24	Control unit#2 baud rate	(*Visible only when parameter 149.21 = Control unit #2*). Sets the baud rate for secondary control unit protocol.	115.2 kbps
	38.4 kbps		1
	57.6 kbps		2
	86.4 kbps		3
	115.2 kbps		4
	230.4 kbps		5

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
150 FBA			
150.01	FBA A Enable	Enables communication between the inverter and fieldbus adapter A.	Disable
	Disable	Communication between inverter and fieldbus adapter A disabled.	0
	Option slot 2	Communication between inverter and fieldbus adapter A enabled.	1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
151 FBA settings			
151.01	FBA type	Displays the type of the connected fieldbus adapter. This parameter is read-only.	None
	None		0
	Ethernet	Type shown when FENA-11/21 is connected.	128
	RS-485 comm	Type shown when FSCA-01 is connected.	485
151.02	Protocol/profile	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Selects the application protocol and communication profile for the network connection. **Note**: Applicable only with profiles MB/TCP T16M and MB/TCP T32M.	MB/TCP ABB C
	MB/TCP ABB C	Modbus/TCP: ABB Drives profile - Classic	0
	MB/TCP ABB E	Modbus/TCP: ABB Drives profile - Enhanced	1
	MB/TCP T16 M	Modbus/TCP: Transparent 16-bit profile	2
	MB/TCP T32 M	Modbus/TCP: Transparent 32-bit profile	3
	MB/UDP ABB C	Modbus over UDP: ABB Drives profile - Classic	4
	MB/UDP ABB E	Modbus over UDP: ABB Drives profile -	5
	MB/UDP T16 M	Modbus over UDP: Transparent 16-bit profile	6
	MB/UDP T32 M	Modbus over UDP: Transparent 32-bit profile	7
151.02	Profile	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Selects the communication profile for the network connection. **Note**: Applicable only with profiles Transp 10 and Transp 32.	Transp 16
	ABB Classic	Modbus/RTU protocol with ABB Drives profile - Classic	0
	ABB Enhanced	Modbus/RTU protocol with ABB Drives profile - Enhanced	1
	Transp 16	Modbus/RTU protocol with Transparent 16-bit profile	2
	Transp 32	Modbus/RTU protocol with Transparent 32-bit profile	3
151.03	Commrate	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Sets the bit rate for the Ethernet interface X1	Auto
	Auto	Auto negotiate	0
	100 Mbps FD	100 Mbps, full duplex	1
	100 Mbps HD	100 Mbps, half duplex	2
	10 Mbps FD	10 Mbps, full duplex	3
	10 Mbps HD	10 Mbps, half duplex	4
151.03	Station ID	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Defines the address of the device. Two units with the same address are not allowed on-line.	1
	1…127	Address of the device	

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
151.04	IP configuration	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Sets the method for configuring the IP address, subnet mask and gateway address for the adapter module.	Dyn IP DHCP
	Static IP	Configuration will be obtained from parameters 05…13.	0
	Dyn IP DHCP	Configuration will be obtained via DHCP.	1
151.04	Baud rate	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Selects the baud rate of the link.	9.6 kbit/s
	9.6 kbit/s	9.6 kbit/s	0
	19.2 kbit/s	19.2 kbit/s	1
	38.4 kbit/s	38.4 kbit/s	2
	57.6 kbit/s	57.6 kbit/s	3
	115.2 kbit/s	115.2 kbit/s	4
	230.4 kbit/s	230.4 kbit/s	5
151.05	IP address 1	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) First octet of FENA IP address (0…255)	0
151.05	Parity	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Defines the use of parity, stop bit(s) and data length. The same settings must be used in all on-line stations.	8 None 1
	8 None 1	No parity bit, one stop bit, 8 data bits	0
	8 None 2	No parity bit, two stop bit, 8 data bits	1
	8 Even 1	Even parity indication bit, one stop bit, 8 data bits	2
	8 Odd 1	Odd parity indication bit, one stop bit, 8 data bits	3
151.06	IP address 2	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Second octet of FENA IP address (0…255)	0
151.06	Modbus timeout	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Sets the timeout after which communication status parameter 151.31 goes to Off-line state unless a new Modbus RTU frame is received. To activate the timeout, set parameter 151.07 = Any message.	0 ms
	0...65535 ms	Time delay in 100 ms before the communication status changes to Off-line state after the last received Modbus RTU frame. **Note**: Value zero (0) disables timeout and communication status remains in On-line state	1 = 100 ms
151.07	IP address 3	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Third octet of FENA IP address (0…255)	0

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
151.07	Timeout mode	(*Visible only when parameter 151.01 FBA type is FSCA-01.*)	None
		Selects the Modbus register access type to reset the timeout counter. See parameter *151.06.*	
	None	Modbus timeout feature is disabled. Communication status in parameter *151.31* remains in On-line state.	0
	Any message	Timeout counter is reset when any Modbus register is accessed.	1
	Ctrl write	Timeout counter is reset when the control word register or reference register REF1/REF2 are written to.	2
		For more information, see *FSCA-01 manual*.	
151.08	IP address 4	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*)	0
		Fourth octet of FENA IP address (0…255)	
151.08	OK messages	(*Visible only when parameter 151.01 FBA type is FSCA-01.*)	0
		Shows the number of valid messages that the inverter has received.	
	0…65535	Number of valid messages	
151.09	Subnet CIDR	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*)	0
		Subnet masks are used for splitting networks into subnets. A subnet mask is a 32-bit binary number that is used to split the IP address into a network address and a host address. Here, the subnet mask is represented by its CIDR notation, as shown in the table below.	
	31	255.255.255.254	31
	30	255.255.255.252	30
	29	255.255.255.248	29
	28	255.255.255.240	28
	27	255.255.255.224	27
	26	255.255.255.192	26
	25	255.255.255.128	25
	24	255.255.255.0	24
	23	255.255.254.0	23
	22	255.255.252.0	22
	21	255.255.248.0	21
	20	255.255.240.0	20
	19	255.255.224.0	19
	18	255.255.192.0	18
	17	255.255.128.0	17
	16	255.255.0.0	16
	15	255.254.0.0	15
	14	255.252.0.0	14
	13	255.248.0.0	13
	12	255.240.0.0	12
	11	255.224.0.0	11

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
	10	255.192.0.0	10
	9	255.128.0.0	9
	8	255.0.0.0	8
	7	254.0.0.0	7
	6	252.0.0.0	6
	5	248.0.0.0	5
	4	240.0.0.0	4
	3	224.0.0.0	3
	2	192.0.0.0	2
	1	128.0.0.0	1
	0	0.0.0.0	0
151.09	CRC errors	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Shows the number of cyclic redundancy check (CRC) error messages received by the inverter.	0
	0…65535	Number of CRC error messages.	
151.10	GW address 1	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) First octet of gateway IP address (0…255)	0
151.10	UART errors	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Shows the number of communication error messages (other types) received by the inverter.	0
	0…65535	Number of communication error messages.	
151.11	GW address 2	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Second octet gateway of IP address (0…255)	0
151.11	Word order	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Selects the order in which 16-bit registers of 32-bit parameters are transferred. For each register (16-bit), the first byte contains the high order byte and the last byte contains the low order byte.	HiLo
	LoHi	The first register contains the low order word and the second register contains the high order word.	0
	HiLo	The first register contains the high order word and the second register contains the low order word.	1
151.12	GW address 3	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Third octet of gateway IP address (0…255)	0
151.12	Address mode	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Defines the mapping between inverter parameters and Modbus holding registers. **Note**: Changes are effective only when the settings are refreshed or the device is power cycled.	Mode 0

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
	Mode 0	Both 16 bit and 32 bit accesses are possible for parameter groups 101...199, indexes 1...99. RegisterAddress for 16bit access = 100*ParamGroup + ParamIndex. RegisterAddress for 32bit access = 20000 + 200*ParamGroup + 2*ParamIndex.	0
	Mode 1	Only 16 bit access is possible, parameter groups 1 ... 255, indexes 1 ... 255. RegisterAddress = 256*ParamGroup + ParamIndex. Note. This mode does not allow access to 32-bit parameter values.	1
	Mode 2	Only 32 bit access is possible, parameter groups 1…127, indexes 1 ... 255. RegisterAddress = 512*ParamGroup + 2*ParamIndex.	2
	Mode 3	Only 32 bit access is possible, parameter groups 1…255, indexes 1...127. RegisterAddress = 256*ParamGroup + 2*ParamIndex.	3
151.13	GW address 4	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Fourth octet of gateway IP address (0…255)	0
151.14	Commrate Port2	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Sets the bit rate for the Ethernet interface X2 (FENA-21 only)	Auto
	Auto	Auto negotiate	0
	100 Mbps FD	100 Mbps, full duplex	1
	100 Mbps HD	100 Mbps, half duplex	2
	10 Mbps FD	10 Mbps, full duplex	3
	10 Mbps HD	10 Mbps, half duplex	4
151.20	Timeout time	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Sets a timeout after which communication status, parameter *151.31*, goes to Off-line state unless a new Modbus TCP frame is received. To activate the timeout, set parameter *151.21* = Any message.	Auto
	0...65535 ms	Time delay in 100 ms before the communication status changes to Off-line state after the last received Modbus TCP frame. **Note**: Value zero (0) disables timeout and communication status remains in On-line state	1 = 100 ms
151.21	Timeout mode	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Selects the Modbus TCP register access type to reset the timeout counter. See parameter *151.20*.	None
	None	Modbus TCP timeout feature is disabled. Communication status in parameter *151.31* remains in On-line state.	0

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
	Any message	Timeout counter is reset when any Modbus TCP register is accessed.	1
	Ctrl write	Timeout counter is reset when the control word register or reference register REF1/REF2 are written to. For more information, see *FENA-11/21 manual*.	2
	Auto	Auto negotiate	0
151.22	Word order	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Selects the order in which 16-bit registers of 32-bit parameters are transferred. For each register (16-bit), the first byte contains the high order byte and the last byte contains the low order byte.	HiLo
	LoHi	The first register contains the low order word and the second register contains the high order word.	0
	HiLo	The first register contains the high order word and the second register contains the low order word.	1
151.23	Address mode	(*Visible only when parameter 151.01 FBA type is FENA-11/-21.*) Defines the mapping between inverter parameters and Modbus holding registers. **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	Mode 0
	Mode 0	Both 16 bit and 32 bit access is possible for parameter groups 101...199, indexes 1...99. RegisterAddress for 16bit access = 100*ParamGroup + ParamIndex. RegisterAddress for 32bit access = 20000 + 200*ParamGroup + 2*ParamIndex.	0
	Mode 1	Only 16 bit access possible, parameter groups 1... 255, indexes 1... 255. RegisterAddress = 256*ParamGroup + ParamIndex. Note. This mode does not allow access to 32-bit parameter values.	1
	Mode 2	Only 32 bit access possible, parameter groups 1…127, indexes 1... 255. RegisterAddress = 512*ParamGroup + 2*ParamIndex.	2
	Mode 3	Only 32 bit access possible, parameter groups 1…255, indexes 1... 127. RegisterAddress = 256*ParamGroup + 2*ParamIndex.	3
151.23	Init status	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Status of adapter module (internal use)	0

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
151.24	Protocol check	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Indicates whether parameters of the selected communication protocol are loaded correctly. If the value is not equal to the setting in parameter *151.25*, refresh settings with parameter *151.27*.	1
	1	Parameters for Modbus RTU has been loaded	1
151.25	Protocol	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Selects the communication protocol for adapter module.	Modbus
	Modbus	Modbus RTU selected	1
	N2	Not applicable	2
	FLN	Not applicable	3
	BACnet	Not applicable	4
	DCP	Not applicable	5
151.26	Protocol sw ver	(*Visible only when parameter 151.01 FBA type is FSCA-01.*) Shows the software version of the selected communication protocol.	-
151.27	FBA par refresh	Commits any changed adapter module configuration parameter settings. After refresh, the value reverts to 0 = Done.	Done
	Done	Refreshing done.	0
	Refresh/Configure	Refreshing.	1
151.28	Par table ver	Adapter parameter table version (internal use)	-
151.29	Drive type code	Adapter inverter type code (Internal use)	620
151.30	Mapping file ver	Mapping file version (Internal use)	-
151.31	D2FBA comm sta	Displays the communication status of the adapter module.	Idle
	Idle	Adapter is not configured.	0
	Exec. Init	Adapter is initializing.	1
	Time out	A timeout has occurred in the communication between the adapter and the inverter.	2
	Conf.err	Adapter configuration error: The major or minor revision code of the common program revision in the adapter module is not the revision required by the module or mapping file upload has failed more than three times.	3
	Off-line	Adapter is off-line.	4
	On-line	Adapter is on-line. **Note**: This is the normal operation state unless the parameters timeout and the Timeout mode is set to non-default values. See parameters *151.06*, *151.07*, *151.20* and *151.21*.	5
	Reset	Adapter is performing a hardware reset.	6
151.32	FBA comm SW ver	Shows the common program revision of the adapter module	-

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
151.33	FBA appl SW ver	Shows the application program revision of the adapter module	-

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
152 FBA A data in			
152.01	FBA data in1	Selects internal data, i.e. parameter group and index, to be transferred from the inverter to the fieldbus adapter and forwarded to the Modbus RTU or TCP fieldbus master.	None
		Data selected for "FBA data in1" appears as "DATA in 1" in the Modbus register map of the fieldbus adapter. It is possible to map a number of internal parameters to a consecutive register area in the fieldbus adapter and then enable the master to read all data in one read operation.	
		For more information, see *FCSA and FENA adapters User's manual*.	
		Note: FBA data in 1 ... 12 are for reading out data from the inverter to the fieldbus master.	
	None		0
	CW 16bit	Currently not in use.	1
	Ref1 16bit	Currently not in use.	2
	Ref2 16bit	Currently not in use.	3
	SW 16bit	Currently not in use.	4
	Act1 16bit	Currently not in use.	5
	Act2 16bit	Currently not in use.	6
	CW 32bit	Currently not in use.	7
	Ref1 32bit	Currently not in use.	8
	Ref2 32bit	Currently not in use.	9
	SW 32bit	Currently not in use.	10
	Act1 32bit	Currently not in use.	11
	Act2 32bit	Currently not in use.	12
	CW2 16bit	Currently not in use.	13
	SW2 16bit	Currently not in use.	14
	Other	Selects any internal parameter of the inverter. The value of the selected parameter appears in the register DATA in 1 of the FENA or FSCA extension module.	
...	...	...	...
152.12	FBA data in12	See parameter *152.01 FBA data in1*	None

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
153 FBA A data out			
153.01	FBA data out1	Selects the destination for data to be transferred from Modbus RTU or TCP fieldbus master. The fieldbus master writes data using a local register map of the fieldbus adapter (FSCA or FENA). The data destination can be any internal parameter of the inverter. **Note**: FBA data out 1 ... 12 are for writing data into parameter groups of the inverter.	None
	None		0
	CW 16bit	Currently not in use.	1
	Ref1 16bit	Currently not in use.	2
	Ref2 16bit	Currently not in use.	3
	CW 32bit	Currently not in use.	4
	Ref1 32bit	Currently not in use.	5
	Ref2 32bit	Currently not in use.	6
	CW2 16bit	Currently not in use.	7
	Other	Selects destination i.e. internal parameter group and index for Modbus RTU or TCP write operation executed by a fieldbus master.	
...	...	...	...
153.12	FBA data out12	See parameter *153.01 FBA data out1*	None

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
158 Embedded fieldbus			
158.01	Protocol enable	Shows the status of embedded Modbus RTU protocol. To change the operational status, see parameter *149.21*. This parameter is read-only.	Modbus RTU
	None	None. Modbus RTU is disabled, see parameter *149.21*.	0
	Modbus RTU	Embedded Modbus RTU protocol is enabled.	1
158.02	Protocol ID	Contains the protocol ID and revision. First 4 bits specify the protocol ID and last 12 bits specify the revision.	-
158.03	Node address	Sets the address of the device on RS485 bus. It is also called as Station ID or Device Address. **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	1
	0 ... 255	Node address	1 = 1
158.04	Baud rate	Selects the communication speed of RS485 bus. **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	19.2 kbps
	Autodetect	Automatic baud rate detection.	0
	9.6 kbps	Force baud rate to 9 600 bps.	2
	19.2 kbps	Force baud rate to 19 200 bps.	3
	38.4 kbps	Force baud rate to 38 400 bps.	4
	57.6 kbps	Force baud rate to 57 600 bps.	5
	76.8 kbps	Force baud rate to 76 800 bps.	6
	115.2 kbps	Force baud rate to 115 200 bps.	7
158.05	Parity	Selects the character framing (bits per character, start/stop bits, parity) for RS485 bus. **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	8 NONE 1
	8 NONE 1	No parity. One stop bit.	0
	8 NONE 2	No parity. Two stop bits.	1
	8 EVEN 1	Even parity. One stop bit.	2
	8 ODD 1	Odd parity. One stop bit.	3
158.06	Comm control	Refreshes the settings made to configuration parameters and restarts the Modbus RTU protocol.	Enabled
	Enabled		0
	Refresh Settings	Restarts the Modbus RTU to activate changes in configuration parameters.	1
	Silent Mode	Puts the Modbus RTU protocol into silent mode. In this mode, all incoming Modbus RTU frames are ignored. Normal operation is resumed only when the inverter is power cycled or the Modbus RTU is restarted (Refresh Settings)	2

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
158.07	Comm diagnostics	Diagnostic parameter for trouble shooting. 1 = indicates an active (fault) condition. 0 = indicates normal operation.	-
	b0: Init failed	1 = EFB initialization failed.	
	b1: Addr config err	1 = Device address is beyond the range of the protocol.	
	b2: Silent mode	1 = EFB is in Listen-only mode. 0 = EFB is not restricted from transmitting.	
	b3: Autobauding	1 = EFB is trying to determine the baud rate.	
	b4: Wiring error	1 = EFB is detecting errors. The B and A communication wires might be swapped.	
	b5: Parity error	1 = EFB is detecting errors. The parity or baud rate setting might not be correct.	
	b6: Baud rate error	1 = EFB is detecting errors. The baud rate or parity setting might not be correct.	
	b7: No bus activity	1 = Zero bytes received during the last 5 seconds.	
	b8: No packets	1 = Zero packets to any device received during the last 5 seconds.	
	b9: Noise or addressing error	1 = EFB is detecting errors. Noise or a duplicate address might be present on the bus.	
	b10: Comm loss	1 = Zero packets (of any type) addressed to device during the configured timeout period. To know when this feature is active, see parameter *158.12* and *158.12*.	
	b11: CW/Ref loss	1 = Zero writes to the control or reference points have occurred during the configured timeout period. See parameter *158.12*.	
	b12: Not active		
	b13: Protocol 1	Not in use.	
	b14: Protocol 2		
	b15: Internal error	1 = Internal error. Refresh parameters or reboot the inverter.	
158.08	Received packets	Packet counter. Increments for every accepted and received message.	0
	0 … 4 294 967 295		- / 1 = 1
158.09	Transmitted packets	Packet counter. Increments for every message the inverter sends.	0
	0 … 4 294 967 295		- / 1 = 1
158.10	All packets	Contains the count of all valid packets to any device on the bus. During normal operation, this number increases constantly. Only writable to zero.	0
	0 … 4 294 967 295		- / 1 = 1
158.11	UART errors	Contains the count of character errors received by the inverter. This is an indicator of a configuration problem on the RS485 bus.	0
	0 … 4 294 967 295		- / 1 = 1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
158.12	CRC errors	Contains the count of CRC error messages received by the device. This is an indicator of noise on the RS485 bus.	0
	0 … 4 294 967 295		- / 1 = 1
158.17	Transmit delay	Defines a minimum response delay in addition to any fixed delay imposed by the protocol. **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	0
158.33	Addressing mode	Defines the mapping between parameters and holding registers in the upper Modbus register range (101... 65536). **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	7
	Mode 1	Only 16bit access is possible for parameter groups 1... 255, indexes 1... 255. RegisterAddress = 256*ParamGroup + ParamIndex. **Note**: This mode does not allow access to 32-bit parameter values.	1
	Mode 6	Both 16bit and 32bit access is possible for parameter groups 101... 199, indexes 1... 99. RegisterAddress for 16bit access = 100*(ParamGroup - 100) + ParamIndex. RegisterAddress for 32bit access = 20000 + 200*(ParamGroup - 100) + 2*ParamIndex.	6
	Mode 7	Only 32bit access is possible for parameter groups 101... 227, indexes 1... 255. RegisterAddress = 512*(ParamGroup - 100) + 2*ParamIndex. **Note**: Only this mode can access all parameter values.	7
158.34	Word order	Selects the order in which 16-bit registers of 32-bit parameters are transferred. **Note**: Changes are effective only when settings are refreshed or the device is power cycled.	LO-HI
	HI-LO	First register contains high order word and second register contains low order word.	0
	LO-HI	First register contains low order word and second register contains high order word.	1
158.101	Data I/O 1	Selects and maps any internal parameter of the inverter to Modbus RTU holding register address 0. Allows the user to define/redefine the mapping scheme that can suit the required Modbus RTU master. See the parameters list and mappings in chapter *Product name and serial number* on page *107*.	-
...	...	...	...
158.169	Data I/O 69	See parameter *158.101 Data I/O 1*	-

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
172 Connection diagnostics			
172.01	Connection status	Shows the connection status of the inverter.	-
	Connected	Connected to the grid.	0
	Regulatory delay	Waiting for a regulatory delay to expire.	1400
	Grid synchronization	Synchronizing to the grid.	1300
	Connection tests	Performing connection tests.	1200
	Grid unstable	Grid is not within country code dependent limits.	1100
	Power-up tests	Performing power-up tests.	1000
	DC undervoltage	DC voltage is too low.	800
	Active fault	A fault is active.	500
	Start inhibit active	Firmware upgrade process has requested a start inhibit.	300
	Country code not set	Country code is not set.	200
	Inverter disabled	Inverter operation is disabled. See parameter *189.01 Inverter operation*.	100
	Other	If none of the other reasons is valid, this value is shown.	1500
	External trip signal	External signal tripped. See parameter *188.16 External trip*.	1150
	DC overvoltage	DC voltage is too high.	820
172.02	Disconnect diagnostic	Shows the reason for last disconnection. Reverts to value *No disconnection* when the inverter connects back to grid.	-
	Inverter disabled	Inverter operation disabled.	100
	DC undervoltage	DC voltage too low.	300
	Faulted	Fault activated.	600
	No disconnection	Inverter is connected to the grid or has not performed disconnection.	700
	Grid overvoltage	Grid voltage too high.	410
	Grid undervoltage	Grid voltage too low.	420
	Grid overfrequency	Grid frequency too high.	430
	Grid underfrequency	Grid frequency too low.	440
	Anti-islanding	Anti-islanding.	444
	Rate of change of freq	Rate of change of frequency has tripped.	445
	External signal	External signal tripped. See parameter *188.16 External trip*.	460
	No grid	No zero crossings in grid voltage.	470
	Combinatory limit	Combinatory limit has tripped.	450
	Low voltage ride through	Low voltage ride-through trip.	480
	High voltage ride through	High voltage ride-through trip.	490
	DC overvoltage	DC voltage too high.	320
172.03	Output power diagnostic	Shows the status of energy generation.	-
	MPPT tracking	System delivers power based upon MPPT.	50
	DC voltage ref	Inverter uses constant DC voltage reference. Inverter's MPPT is not used.	100

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
	Min DC voltage	MPPT has reached the minimum DC voltage level. System delivers power at the rate necessary to maintain DC input voltage within the operating range.	200
	At power	System delivers power according to the selected power reference.	300
	Disconnected	Inverter is disconnected.	800
	Other	If none of the other reasons is valid, this value is shown.	0
	Max DC Voltage	MPPT has reached the maximum DC voltage level. System delivers power at the rate necessary to maintain DC input voltage within the operating range.	220
	Active power limited	Inverter limits active power. See parameter *130.01 Limit word 1*.	500
172.04	Connection 1 date	Latest connection date.	-
172.05	Connection 1 time	Latest connection time.	-
172.06	Connection 2 date	2nd latest connection date.	-
172.07	Connection 2 time	2nd latest connection time.	-
172.08	Connection 3 date	3rd latest connection date.	-
172.09	Connection 3 time	3rd latest connection time.	-
172.10	Connection 4 date	4th latest connection date.	-
172.11	Connection 4 time	4th latest connection time.	-
172.12	Connection 5 date	5th latest connection date.	-
172.13	Connection 5 time	5th latest connection time.	-
172.20	Grid monitoring SW1	Shows grid monitoring status word 1 (SW1). 0 = Inactive status 1 = Active status, triggered or enabled	-
	b0: Grid stable	Criteria for stable grid conditions are fulfilled.	
	b1: Parameters	All grid monitoring parameters are initialized successfully.	
	b2...b15: Reserved		
172.21	Grid monitoring SW2	Shows the grid monitoring status word 2 (SW2). 0 = Inactive status 1 = Active status, triggered or enabled	-
	b0: Connect underfrequency		
	b1: Connect overfrequency		
	b2: Connect undervoltage		
	b3: Connect overvoltage		
	b4: Underfrequency 1		
	b5: Underfrequency 2		
	b6: Overfrequency 1		
	b7: Overfrequency 2		
	b8: Undervoltage 1		

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
	b9: Undervoltage 2		
	b10...b11: Reserved		
	b12: Overvoltage 1		
	b13: Overvoltage 2		
	b14: Overvoltage 3		
	b15: Sliding overvoltage		
172.22	Grid monitoring SW3	Shows the grid monitoring status word 3 (SW3). 0 = Inactive status 1 = Active status, triggered or enabled	-
	b0: Combinatory limit		
	b1: Reserved		
	b2: RoCoF		
	b3...b6: Reserved		
	b7: Anti-islanding		
	b8...b15: Reserved		

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
173 Inverter diagnostics			
173.01	Uptime	Shows inverter uptime counter.	-
	0 … 4294967295 h		- / 1 = 1 h
173.02	Operation time	Shows inverter operation time.	-
	0 … 4294967295 h		1 = 1 h
173.03	Internal fan run time	Shows run time of internal fan.	0 h
	0 … 4294967295 h		- / 1 = 1 h
173.04	External fan 1 run time	Shows run time of external fan 1.	0 h
	0 … 4294967295 h		- / 1 = 1 h
173.05	External fan 2 run time	Shows run time of external fan 2.	0 h
	0 … 4294967295 h		- / 1 = 1 h
173.06	Internal fan speed	Shows RPM of the internal fan.	0 rpm
	0 … 10 000 rpm		1 = 1 rpm
173.07	External fan 1 speed	Shows RPM of external fan 1 located on the right side of the inverter.	0 rpm
	0 … 10 000 rpm		1 = 1 rpm
173.08	External fan 2 speed	Shows RPM of external fan 2 located on the left side of the inverter.	0 rpm
	0 … 10 000 rpm		1 = 1 rpm
173.18	Power-up tests	Shows number of times the inverter was powered up.	-
	0 … 4294967295		- / 1 = 1
173.19	Connection tests	Shows number of grid connection tests.	0
	0 … 4294967295		- / 1 = 1
173.20	Grid connections	Shows amount of grid connections.	0
	0 … 4294967295		- / 1 = 1
173.21	Ground impedance Zn	Shows measured impedance from negative pole to ground.	0 MOhm
	-1000 … 1000 MOhm		- / 1000 = 1 MOhm
173.22	Ground impedance Zp	Shows the measured impedance from positive pole to ground.	0 MOhm
	-1000 … 1000 MOhm		- / 1000 = 1 MOhm
173.23	Control board temperature	Control board temperature.	-
	0 … 127 °C		1 = 1 °C
173.24	Inverter temperature A	Inverter phase A IGBT module.	-
	-80 … 150 °C		1 = 1 °C
173.25	Inverter temperature B	Inverter phase B IGBT module.	-
	-80 … 150 °C		1 = 1 °C
173.26	Inverter temperature C	Inverter phase C IGBT module.	-
	-80 … 150 °C		1 = 1 °C

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
173.27	Line filter temperature	Line filter temperature.	-
	-80 … 150 °C		1 = 1 °C
173.30	SPD installed	Indicates whether a Surge Protection Device (SPD) is installed. • If a SPD is detected in the system, the parameter is automatically set to *Yes*. • If SPD is permanently removed from system, manually set this parameter to *No*. Otherwise, a warning is indicated at the time of inverter power up.	No
	No	SPD is not detected.	0
	Yes	SPD is detected.	1
173.31	Ground impedance parallel	Shows measured ground impedance.	0 MOhm
	-1000 … 1000 MOhm		- / 1000 = 1 MOhm
173.32	Ground current RMS	Shows residual ground current as measured by the internal residual current monitoring unit (RCMU).	-
	0...1000 mA		1 = 1 mA
173.33	Ground current resistive	Shows the resistive or DC part of the residual ground current as measured by the RCMU.	-
	-1000...1000 mA		1 = 1 mA
173.34	RCMU test current	Shows test current used for self-test of the RCMU.	0.0 mA
	-325.0 ... +325.0 mA		10 = 1 mA
173.36	Ground current meas. diff RMS	Shows difference between monitoring channels. The system uses two separate channels for obtaining the residual current reading from the RCMU. A fault is raised if the difference is too big.	0
	0.0 ... 1000.0 mA		1 = 1 / 10 = 1 mA
173.80	Control unit comm status	Shows status of the communication link between the PVS-AP-L control unit and the inverter firmware.	0
	0	Link is down	0
	1	Link is up	1
173.81	Control unit service status	Packet counter which counts application service transactions between the PVS-AP-L control unit and the inverter firmware. The counter wraps around to zero after 65535. The counter increments rapidly when the control unit is operated by the user and slows down to one increment per minute when the control unit has turned on the screen saver.	0
	0...65535		1 = 1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
174 String monitor			
174.02	String monitor action	Selects how the inverter should react when a deviation is detected in the string currents.	Warning
	No	Any deviations are ignored.	0
	Warning	A warning is indicated.	1
	Fault	A fault event occurs and the inverter trips.	2
174.11	Input connection status	Sets the connection status of each string.	0b00000000
	String 1	String 1 is configured.	0
	...	...	...
	String 8	String 8 is configured.	7
	Reserved		8...15
174.12	Reverse string current detection	Enables reverse current detection.	Enable
	Disable		0
	Enable		1
174.13	Reverse string current limit	Sets the reverse current detection limit.	0.3 A
	0 … 0.34 A		100 = 1 A
174.14	String current detection	Enables the string current deviation detection. **Note**: String current detection is available only in -SX models that includes a string combiner with DC fuses.	Disable
	Disable		0
	Enable		1
174.15	String monitor delay	Sets the duration of how long the current deviation must be above limit before defined action of the string monitor is triggered.	1 min
	0 … 1440 min		1 = 1 min
174.16	Comparison mode	Selects the comparison mode of the string current deviation detection.	Relative
	Absolute	The string current deviation is detected by comparing the difference in amperes.	0
	Relative	The string current deviation is detected by comparing the difference in percents of reference value.	1
174.17	Reference type	Selects the current reference type of the string monitor.	Mean
	Max	The reference is the maximum value.	0
	Mean	The reference is the mean value.	1
174.18	Relative current limit	Sets the relative string current limit: maximum allowed difference in percent between each string and the reference value.	30%
	0 … 100%		1 = 1%
174.19	Absolute current limit	Sets the absolute string current limit: maximum allowed difference in amperes between each string and the reference value.	1 A
	0 … 100 A		1 = 1 A / 10 = 1 A

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
174.20	Relative threshold	Sets the relative string current threshold value. Below this value the relative difference detection is disabled.	1 A
	0 … 100 A		1 = 1 A / 10 = 1 A
174.22	Blown fuse detection	Enables the blown fuse detection. Requires a fuse board to be installed.	Enable
	Disable		0
	Enable		1
174.23	Blown fuse tolerance	Sets blown fuse detection tolerance.	0.1 A
	0 … 100 A		1 = 1 A / 10 = 1 A
174.24	Blown fuse active boundary	Sets the blown fuse detection boundary. If mean current of the corresponding input is below this value, blown fuse detection is not enabled.	1 A
	0 … 100 A		1 = 1 A / 10 = 1 A
174.30	Reverse input current detection	Enables reverse input current detection.	Enable
	Disable		0
	Enable		1
174.31	Reverse input current limit	Sets the reverse input current detection limit.	1 A
	0 … 1.5 A		100 = 1 A
174.32	Reverse input current delay	Sets the duration for how long the reverse input current must be above the limit before indicating a fault.	10 s
	0 … 600 s		1 = 1 s
174.35	Reverse string current threshold	Sets the activation power level in percent of the nominal power for reverse string current detection.	10%
	0 … 100%		1 = 1%
174.36	Reverse string current delay	Sets the duration for how long the reverse string current must be above the limit before indicating a warning. **Note**: Reverse string current detection is available only in -SX model.	60 s
	0 … 600 s		1 = 1 s
174.50	Current: [1]	Measured current of string 1.	-
	-15 … 15 A		100 = 1 A
174.51	Current: [2]	Measured current of string 2.	-
	-15 … 15 A		100 = 1 A
174.52	Current: [3]	Measured current of string 3.	-
	-15 … 15 A		100 = 1 A
174.53	Current: [4]	Measured current of string 4.	-
	-15 … 15 A		100 = 1 A

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
174.54	Current: [5]	Measured current of string 5.	-
	-15 … 15 A		100 = 1 A
174.55	Current: [6]	Measured current of string 6.	-
	-15 … 15 A		100 = 1 A
174.56	Current: [7]	Measured current of string 7.	-
	-15 … 15 A		100 = 1 A
174.57	Current: [8]	Measured current of string 8.	-
	-15 … 15 A		100 = 1 A

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
178 MPPT settings			
178.03	Minimum voltage ref	Sets the minimum MPPT voltage reference.	500 V
	0 … 1000 V		1 = 1 V
178.04	Maximum voltage ref	Sets the maximum MPPT voltage reference.	950 V
	0 … 1000 V		1 = 1 V
178.12	Zero power level	Sets power level in percent of nominal output power where MPPT considers power to equal 0% and starts to reduce the DC voltage. This avoids MPPT from drifting at voltages above the panel open circuit voltage.	1%
	0 … 10%		1 = 1%
178.50	MPPT status word	Shows the MPPT status word.	
	b0: MPPT	MPPT is active.	
	b1: Limited mode	Tracking is not active because active power is limited.	
	b2: Minimum voltage	MPPT reference is at the minimum voltage.	
	b3: Maximum voltage	MPPT reference is at the maximum voltage.	
	b4...b15: Reserved		
178.51	Input power	Shows sum of DC string input power.	-
	-		100 = 1 kW

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
179 Energy saving			
179.01	CO2 reduction	Shows reduction in CO2 emissions when energy is produced by a solar plant instead of a conventional fossil fueled plant. The value is calculated by multiplying produced energy with a conversion factor (CO2 reduction factor).	-
	0 … 2147483 t		1 = 1 t / 1000 = 1 t
179.02	CO2 reduction factor	Sets the conversion factor to calculate CO2 reduction from produced energy.	0.7
	0 … 65500		1 = 1 t / 1000 = 1 t

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
180 Day production			
180.01	Hour 0 energy	Shows energy produced during the first hour of current day.	-
	0 … 655 kWh		1 = 1 kWh / 100 = 1 kWh
...	...	...	...
180.24	Hour 23 energy	Shows energy produced during the last hour of current day.	

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
181 Month production			
181.01	Day 1 energy	Shows energy produced during the first day of current month.	-
	0 … 279000 kWh		1 = 1 kWh / 10 = 1 kWh
...	...	...	...
181.31	Day 31 energy	Shows energy produced during the last day of current month.	

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
182 Year production			
182.01	Month 1 energy	Shows energy produced during the first month of current year.	-
	0 … 279000 kWh		1 = 1 kWh
...	...	...	...
182.12	Month 12 energy	Shows energy produced during the last month of current year.	

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
183 24 years production			
183.01	Year 0 energy	Shows energy produced in one year for all of product lifetime after first start-up.	-
	0 … 279000 kWh		1 = 1 kWh
...	...	...	...
183.24	Year 23 energy	See parameter *183.01 Year 0 energy*	
183.25	Energy counter, resettable	Shows total produced energy since last reset. Writing 0 resets the counter.	0 kWh
	-		- / 100 = 1 kWh
183.26	Total Energy	Shows total produced energy.	-
	-		- / 1 = 1 kWh

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
184 Logger setup			
184.01	Startup date	Sets start-up date. The date should be defined as the starting year of energy logging. Days since 1.1.1980.	-
	0 … 43440 days		1 = 1 day
184.02	Last Boot Time, Days	Shows the date saved at power failure to update loggers accordingly in the next power-up. This date indicates the day when device was shut down.	-
	0 … 65500 days		1 = 1 day
184.03	Last Boot Time, Ticks	Shows the time saved at power failure to update energy loggers accordingly in the next power-up.	-
	0 … 864000000		- / 1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
188 Grid monitoring			
188.01	Country code	Sets installation country.	0
		Changing this value sets the default and/or mandatory values for all other country parameters. This value is initially set by the first start assistant which is run at first startup of the inverter.	
	0 … 34		1 = 1
188.02	Nominal LL voltage	Sets nominal line-to-line voltage.	400 V
	-		1 = 1 V
188.03	Nominal phase voltage	Sets nominal phase voltage.	230 V
	-		1 = 1 V
188.04	Nominal frequency	Sets nominal grid frequency.	50 Hz
	-		1 = 1 Hz / 10 = 1 Hz
188.05	Refresh	Refreshes grid monitoring parameter settings.	Done
	Done		0
	Yes		1
188.06	Voltage source	Selects voltage to be used for checking grid voltage limits.	Main
	Main		0
	Phase		1
188.10	Initial connection delay	Sets time delay for initial grid connection.	5 s
	-		1 = 1 s
188.11	Reconnection delay	Sets reconnection time delay.	300 s
	-		1 = 1 s
188.12	Quick disturbance limit	Sets limit for quick disturbance protection.	0 s
	-		1 = 1 s
188.13	Quick reconnection delay	Sets quick reconnection time delay.	5 s
	-		1 = 1 s
188.16	External trip	Signals external grid monitoring trip. Inverter is disconnected from the AC grid.	0
	0 … 1		1 = 1
188.19	Zero cross monitor enable	Enables zero cross detection in grid monitoring.	1
	0 … 1		1 = 1
188.20	Connect underfrequency type	Selects connection type for underfrequency protection.	Disabled
	Disabled	Limit is disabled.	0
	Disconnected	Limit is enabled when the inverter is disconnected from the grid.	1
	Reconnection	Limit is enabled when inverter trips to underfrequency.	2

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
188.21	Connect underfrequency limit	Sets limit that is used only on connecting to the grid. When the inverter is connected, this limit is disabled. See parameter *188.20 Connect underfrequency type*.	-2 Hz
	-		1 = 1 Hz / 100 = 1 Hz
188.22	Connect overfrequency type	Selects connection type for overfrequency protection.	Disabled
	Disabled	Limit is disabled.	0
	Disconnected	Limit is enabled when the inverter is disconnected from the grid.	1
	Reconnection	Limit is enabled when inverter trips to overfrequency.	2
188.23	Connect overfrequency limit	Sets limit that is used only on connecting to the grid. When the inverter is connected, this limit is disabled. See parameter *188.22 Connect overfrequency type*.	2 Hz
	-		1 = 1 Hz / 100 = 1 Hz
188.24	Connect undervoltage type	Defines how *188.25 Connect undervoltage limit* behaves. • When enabled, grid connection is allowed only when grid voltage is above the limit. • When disabled, limit is not checked.	Disable
	Disable		0
	Enable		1
188.25	Connect undervoltage limit	Sets the limit that is used only when the inverter is not connected. The limit is disabled when the inverter is connected. The purpose is to allow different connect and disconnect limits. See parameter *188.24 Connect undervoltage type*.	80
	-		1 = 1
188.26	Connect overvoltage type	Defines how *188.27 Connect overvoltage limit* behaves. • When enabled, grid connection is allowed only when grid voltage is above the limit. • When disabled, limit is not checked.	Disable
	Disable		0
	Enable		1
188.27	Connect overvoltage limit	Sets the limit used only when the inverter is not connected. The limit is disabled when the inverter is connected. The purpose is to allow different connect and disconnect limits. See parameter *188.26 Connect overvoltage type*.	120
	-		1 = 1
188.30	Underfrequency enable 1	Enables underfrequency protection.	1
	0 ... 1		1 = 1
188.31	Underfrequency limit 1	Sets limit for underfrequency protection.	-1 Hz
	-30 ... 0 Hz		1 = 1 Hz / 10 = 1 Hz

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
188.32	Underfrequency time 1	Sets trip time for underfrequency protection.	100 ms
	0 ... 120 000 ms		1 = 1 ms
188.33	Underfrequency enable 2	Enables underfrequency protection.	1
	0 ... 1		1 = 1
188.34	Underfrequency limit 2	Sets limit for underfrequency protection.	-1 Hz
	-30 ... 0 Hz		1 = 1 Hz / 10 = 1 Hz
188.35	Underfrequency time 2	Sets trip time for underfrequency protection.	100 ms
	0 ... 120 000 ms		1 = 1 ms
188.40	Overfrequency enable 1	Enables overfrequency protection.	1
	0 ... 1		1 = 1
188.41	Overfrequency limit 1	Sets limit for overfrequency protection.	1 Hz
	0 ... 30 Hz		1 = 1 Hz / 10 = 1 Hz
188.42	Overfrequency time 1	Sets trip time for overfrequency protection.	100 ms
	0 ... 120 000 ms		1 = 1 ms
188.43	Overfrequency enable 2	Enables overfrequency protection.	1
	0 ... 1		1 = 1
188.44	Overfrequency limit 2	Sets limit for overfrequency protection.	1 Hz
	0 ... 30 Hz		1 = 1 Hz / 10 = 1 Hz
188.45	Overfrequency time 2	Sets trip time for overfrequency protection.	100 ms
	0 ... 120 000 ms		1 = 1 ms
188.50	Undervoltage enable 1	Enables undervoltage protection.	1
	0 ... 1		1 = 1
188.51	Undervoltage limit 1	Sets limit for undervoltage protection.	80
	0 ... 100%		1 = 1
188.52	Undervoltage time 1	Sets trip time for undervoltage protection.	100 ms
	0 ... 120 000 ms		1 = 1 ms
188.53	Undervoltage enable 2	Enables undervoltage protection.	0
	0 ... 1		1 = 1
188.54	Undervoltage limit 2	Sets limit for undervoltage protection.	80%
	0 ... 100%		1 = 1%
188.55	Undervoltage time 2	Sets trip time for undervoltage protection.	0 ms
	0 ... 120 000 ms		1 = 1 ms
188.63	Overvoltage enable 1	Enables overvoltage protection.	1
	0 ... 1		1 = 1
188.64	Overvoltage limit 1	Sets limit for overvoltage protection.	110
	100 ... 200%		1 = 1
188.65	Overvoltage time 1	Sets trip time for overvoltage protection.	100 ms
	0 ... 120 000 ms		1 = 1 ms

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
188.66	Overvoltage enable 2	Enables overvoltage protection.	0
	0 ... 1		1 = 1
188.67	Overvoltage limit 2	Sets limit for overvoltage protection.	120
	100 ... 200%		1 = 1
188.68	Overvoltage time 2	Sets trip time for overvoltage protection.	0 ms
	0 ... 120 000 ms		1 = 1 ms
188.69	Overvoltage enable 3	Enables overvoltage protection.	0
	0 ... 1		1 = 1
188.70	Overvoltage limit 3	Sets limit for overvoltage protection.	130
	100 ... 200%		1 = 1
188.71	Overvoltage time 3	Sets trip time for overvoltage protection.	0 ms
	0 ... 120 000 ms		1 = 1 ms
188.72	Sliding overvoltage enable	Enables sliding overvoltage protection.	0
	0 ... 1		1 = 1
188.73	Sliding overvoltage limit	Sets limit for sliding overvoltage protection.	120%
	100 ... 200%		1 = 1%
188.74	Sliding overvoltage time	Sets trip time for sliding overvoltage protection.	100 ms
	0 ... 60 000 ms		1 = 1 ms
188.80	Combinatory trip	Enables combinatory protection.	0
	0 ... 1		1 = 1
188.81	Combinatory trip time	Sets trip time for combinatory protection.	100 ms
	0 ... 60 000 ms		1 = 1 ms
188.84	Comb pos seq voltage limit	Sets positive sequence voltage limit in percent of nominal line-to-line AC voltage for combinatory protection.	130%
	0 ... 200%		1 = 1 %
188.85	Comb neg seq voltage limit	Sets negative sequence voltage limit in percent of nominal line-to-line AC voltage for combinatory protection.	10%
	0 ... 200%		1 = 1%
188.86	Comb underfrequency limit	Sets limit for combinatory underfrequency protection.	-5 Hz
	-30 ... 0 Hz		1 = 1 Hz / 10 = 1 Hz
188.87	Comb overfrequency limit	Sets limit for combinatory overfrequency protection.	5 Hz
	0 ... 30 Hz		1 = 1 Hz / 10 = 1 Hz
188.110	Rate of change of freq enable	Enables rate of change of frequency limit.	0
	0 ... 1		1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
188.111	Rate of change of freq limit	Sets rate at which frequency is allowed to change.	1 Hz
	0 ... 10 Hz		1 = 1 Hz / 10 = 1 Hz
188.120	1-phase AI	Enables single phase anti-islanding.	Enable
	Disable	Single phase anti-islanding is Off.	0
	Enable	Single phase anti-islanding is On.	1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
189 Inverter control			
189.01	Inverter operation	Enables inverter operation. Inverter connects to grid only when it is enabled. When disabled, inverter disconnects immediately from the AC grid.	0
	0 … 1	0 = Inverter disabled 1 = Inverter enabled	1 = 1
189.07	Night mode	Sets night mode.	Sleep
	Monitor	Inverter stays powered up from AC grid during the night time.	0
	Sleep	Inverter is powered down during the night time. The rise of the DC voltage or control unit interaction wakes up the inverter from sleep.	1
189.20	Disconnection delay	Defines time limit for disconnection. Active power must be less than disconnecting level for this amount of time for the inverter to disconnect.	30 min
	0 … 180 min		1 = 1 min
189.21	Disconnection power	Defines power level for inverter to disconnect from grid. See also description in chapter *Program features*.	1%
	0 … 10%		10 = 1%
189.30	Output DC protection	Enables output DC current monitoring and protection.	1
	0 … 1		1 = 1
189.33	DC protection limit	Sets allowed level of DC component in the measured inverter current.	1 A
	0 … 10 A		1 = 1 A / 100 = 1 A
189.38	DC protection limit slow	Sets allowed level of DC component in the measured inverter current. This value is used in slow detection.	0.25 A
	0 … 10 A		1 = 1 A / 1000 = 1 A

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
190 External measurements			
190.01	Phase voltage U1	RMS value of phase voltage U1.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V
190.02	Phase voltage V1	RMS value of phase voltage V1.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V
190.03	Phase voltage W1	RMS value of phase voltage W1.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V
190.06	Main voltage U1-V1	RMS value of line-to-line voltage U1-V1.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V
190.07	Main voltage V1-W1	RMS value of line-to-line voltage V1-W1.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V
190.08	Main voltage W1-U1	RMS value of line-to-line voltage W1-U1.	-
	0 … 2 000 V		1 = 1 V / 100 = 1 V

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
196 System			
196.01	Language	Selects language.	-
	Not selected	Language is not selected.	0
	English US	English (United States)	1033
	Deutsch	German (Germany)	1031
	Italiano	Italian (Italy)	1040
	Español	Spanish (Spain	3082
	Français	French (France)	1036
196.02	Passcode	Allows typing passcode to activate further access levels, for example, additional parameters.	-
196.06	Param restore	Restores original settings of the application, that is, the parameter factory default values.	Done
	Done	Restoring is completed.	0
	Restore defs	All parameter values are restored to default values, except Ext-IO, fieldbus and operation settings.	8
	Clear all	All parameter values are restored to default values.	62
196.07	Param save	Saves valid parameter values to the permanent memory. **Note**: A new parameter value is saved automatically when changed from the PC tool or panel but not when changes through a fieldbus connection.	Done
	Done	Save completed.	0
	Save	Save in progress.	1
196.08	Control board boot	Changing this value to one (1) reboots the control board. **Note**: Before changing the value, make sure inverter is disabled with parameter *189.01 Inverter operation*.	-
	0 … 1		1 = 1
196.24	Full days since 1st Jan 1980	Sets day count starting from 1st of January 1980 (= 1). This parameter together with *196.25 Time in minutes within 24 h* and *196.26 Time in ms within one minute* makes it possible to set the date and time in the inverter via the fieldbus parameter interface.	-
	1 ... 59999	Days since beginning of year 1980.	1 = 1 day
196.25	Time in minutes within 24 h	Sets the number of full minutes passed since midnight. For example, the value 860 corresponds to 2:20 pm. See parameter *196.24 Full days since 1st Jan 1980*.	-
	0 ... 1439 min	Minutes since midnight.	1 = 1 min

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
196.26	Time in ms within one minute	Sets the number of milliseconds passed since last minute. See parameter *196.24 Full days since 1st Jan 1980*.	0 ms
	0 ... 59999 ms	Number of milliseconds since last minute.	1 = 1 ms
196.29	Time source status	Shows the status and priority of active time source.	
	b1: Aux Time tick received	Time tick from the second priority source is received.	
	b2: Tick interval is too long	Accuracy of inverter's time is compromised due to a long tick interval.	
	b3: DDCS controller	Tick is received from DDCS controller.	
	b4: Master/Follower	Tick is received from Master/Follower link.	
	b5: Reserved	-	
	b6: D2D	Tick is received from D2D link.	
	b7: FbusA	Tick is received from fieldbus adapter FBA.	
	b8: FbusB	Not in use.	
	b9: EFB	Tick is received from embedded fieldbus.	
	b10: Ethernet	Not in use.	
	b11: Panel link	Tick is received from PVS-AP-L control unit or the Drive composer tool.	
	b12: Ethernet tool link	Tick is received via FENA-11/21 over ethernet from Drive composer tool.	
	b13: Parameter setting	Time and date are set with parameters.	
	b14: RTC	Not in use.	
	b15: Drive On-Time	Time and date originate from the system clock of the operating system. The status indicates that system time was not synchronized with an external time source for some time and time keeping might not be accurate.	
196.30	System time - days	Reads system date, days since 31.12.1979. 1 = 1.1.1980	0
	0 … 65535		1 = 1
196.31	System time - seconds	Reads system time, seconds since 00:00:00	0
	0...86399		1 = 1
196.51	Clear fault and event logger	Setting this parameter to one (1) clears the fault and event loggers. Parameter value returns to zero automatically.	-
	0 … 65535		1 = 1

No.	Name/Value/Range	Description	Default
			FbEq (16b/32b)
202 Fan settings			
202.01	Reset internal fan run time	Resets run time counter of internal fan.	0
	0 … 1		1 = 1
202.02	Reset external fan 1 run time	Resets run time counter of external fan 1.	0
	0 … 1		1 = 1
202.03	Reset external fan 2 run time	Resets run time counter of external fan 2.	0
	0 … 1		1 = 1

No.	Name/Value/Range	Description	Default FbEq (16b/32b)
209 Misc			
209.06	Minimum ground impedance	Sets fault level for ground impedance.	0.20 MOhm
	0 ... 10 MOhm	Fault level.	- / 100 = 1 MOhm
209.10	Ext-IO status word	Shows the status of output power.	
	b0: Grid connected	True when connected to the grid.	
	b1: Power level 20%	True when the output power is over 20%.	
	b2: Power level 40%	True when the output power is over 40%.	
	b3: Power level 70%	True when the output power is over 70%.	
	b4...15: Reserved	-	
209.11	Limit priority	Defines whether active or reactive current has priority when current must be limited.	Active current
	Active current	Limits reactive current before active current.	1
	Reactive current	Limits active current before reactive current.	2

5

Fieldbus interfaces

Contents of this chapter

This chapter describes how to configure the inverter as a slave on an RS-485 bus for communication with a Modbus RTU master.

Fieldbus adapter modules

The PRO-33.0-TL inverter is equipped with expansion slots for Modbus RTU and TCP fieldbus adapter modules. The inverter firmware supports FSCA-01 and FENA-01/11/21 range of fieldbus adapters which can be installed to add an additional communication link in case the embedded fieldbus interface is reserved for other use. For installation and setup of these modules, refer to the *List of related manuals* on page *2*.

Embedded fieldbus

The PRO-33.0-TL inverter is equipped with an embedded fieldbus slave which allows the inverter to communicate with third party Modbus masters using the Modbus RTU protocol.

Connecting inverter to fieldbus network

Connect the fieldbus cable to terminal X2 on the inverter(s). X2 is the connection point for the daisy-chained RS-485 transmission line with one master and multiple slaves. Set the termination resistor switches, S1, so that only the inverter at the end of line is terminated. A connection example and the pin configuration are described in the *PRO-33.0-TL Product manual* (3AUA0000123261 [English]).

Setting up embedded fieldbus interface

Set up the inverter for embedded fieldbus communication from the communication menu or with the parameters in the group *158 Embedded fieldbus*. Modbus RTU is enabled by default. Set a unique node address for each inverter with the parameter *158.03 Node address*. Check also other communication settings including baud rate and parity. The new settings will take effect once refreshed with the parameter *158.06 Comm control*. Parameter *158.01 Protocol enable* is read only. For options, see parameter *149.21 Terminal X2*.

Accessing inverter parameters

Configuration parameters of the PRO-33.0-TL inverter can be accessed through Modbus holding registers. Holding registers are 16-bit, read/write registers. The table below describes the holding registers of the inverter. Registers 0 through 68 are described in detail in a separate table. Registers 100 through 65535 are accessed using an addressing scheme defined by parameter *158.33 Addressing mode*.

Start address	End address	Description
0	68	Data I/O
69	88	Not used
89	99	Modbus error codes
100	65535	Read/write registers

■ Data I/O registers, 0-68

The Data I/O registers are Modbus RTU holding registers that can be programmed to give access to any of the internal configuration parameters of the inverter. Parameters can both be read and written to by accessing these registers, both 16-bit or 32-bit formats are supported. The Data I/O registers give the user the possibility to group a number of internal configuration parameters, with mixed 16/32 bit length, into a contiguous array of registers that can be read in one operation by the Modbus master.

The Modbus data I/O registers are programmed via configuration parameters in parameter group 158, indexes 101 ... 169. Most of the Data I/O registers have default configurations but these can easily be changed when/if needed.

The Data I/O registers have, by default, been set up to mirror internal configuration parameters as described in the tables below.

Data I/O registers 0 ... 2 programmed for inverter control command:

Holding register	FbEq (16b/32b), scaling	Description	Mirrored inverter parameter	Config Parameter	Name
0	16b, 1 = 1	Inverter operation	189.01	158.101	Data I/O 1
1	16b, 1 = 1	External power limit	130.75	158.102	Data I/O 2
2	16b, 1 = 1	User Qref	124.01	158.103	Data I/O 3

Data I/O registers 3 ... 53 programmed for the VSN-700 logger:

Holding register	FbEq (16b/32b), scaling	Description	Mirrored inverter parameter	Config Parameter	Name
3	16b, 10 = 1	DC voltage	101.01	158.104	Data I/O 4
4	16b, 10 = 1	Line current	101.02	158.105	Data I/O 5
5	16b, 100 = 1	Frequency	101.08	158.106	Data I/O 6
6	16b, 10 = 1	Apparent power	101.10	158.107	Data I/O 7
7	16b, 10 = 1	Power	101.10	158.108	Data I/O 8
8	16b, 10 = 1	Reactive power	101.14	158.109	Data I/O 9
9	16b, 100 = 1	CosPhi	101.16	158.110	Data I/O 10
10	16b, 10 = 1	Input current	101.30	158.111	Data I/O 11
11	16b	Tripping fault	104.01	158.112	Data I/O 12
12	16b	Active warning 1	104.06	158.113	Data I/O 13
13	16b	Active warning 2	104.07	158.114	Data I/O 14
14	16b	Active warning 3	104.08	158.115	Data I/O 15
15	16b	Active warning 4	104.09	158.116	Data I/O 16
16	16b	Active warning 5	104.10	158.117	Data I/O 17
17	16b	Latest warning	104.16	158.118	Data I/O 18
18	16b	Main status word	106.11	158.119	Data I/O 19
19	16b	Cpu usage	107.11	158.120	Data I/O 20
20	32b	Connection status	172.01	158.121	Data I/O 21
21		Reserved			Data I/O 22
22	32b	Disconnect diagnostic	172.02	158.123	Data I/O 23
23		Reserved			Data I/O 24
24	32b	Output power diagnostic	172.03	158.125	Data I/O 25
25		Reserved			Data I/O 26
26	32b, 1 = 1	Uptime	173.01	158.127	Data I/O 27
27		Reserved			Data I/O 28
28	16b, 1 = 1	Operation time	173.02	158.129	Data I/O 29
29	16b, 1 = 1	Internal fan speed	173.06	158.130	Data I/O 30
30	16b, 1 = 1	External fan 1 speed	173.07	158.131	Data I/O 31
31	16b, 1 = 1	External fan 2 speed	173.08	158.132	Data I/O 32
32	32b, 1 = 1	Grid connections	173.20	158.133	Data I/O 33
33		Reserved			Data I/O 34
34	16b, 1 = 1	Control board temperature	173.23	158.135	Data I/O 35
35	16b, 1 = 1	Inverter temperature A	173.24	158.136	Data I/O 36
36	16b, 1 = 1	Inverter temperature B	173.25	158.137	Data I/O 37
37	16b, 1 = 1	Inverter temperature C	173.26	158.138	Data I/O 38
38	16b, 100 = 1	Current: [1]	174.50	158.139	Data I/O 39
39	16b, 100 = 1	Current: [2]	174.51	158.140	Data I/O 40
40	16b, 100 = 1	Current: [3]	174.52	158.141	Data I/O 41
41	16b, 100 = 1	Current: [4]	174.53	158.142	Data I/O 42
42	16b, 100 = 1	Current: [5]	174.54	158.143	Data I/O 43
43	16b, 100 = 1	Current: [6]	174.55	158.144	Data I/O 44
44	16b, 100 = 1	Current: [7]	174.56	158.145	Data I/O 45
45	16b, 100 = 1	Current: [8]	174.57	158.146	Data I/O 46

Holding register	FbEq (16b/32b), scaling	Description	Mirrored inverter parameter	Config Parameter	Name
46	32b, 1 = 1	Total energy	183.26	158.147	Data I/O 47
47		Reserved			Data I/O 48
48	16b, 1 = 1	Phase voltage U1	190.01	158.149	Data I/O 49
49	16b, 1 = 1	Phase voltage V1	190.02	158.150	Data I/O 50
50	16b, 1 = 1	Phase voltage W1	190.03	158.151	Data I/O 51
51	16b, 1 = 1	Main voltage U1-V1	190.06	158.152	Data I/O 52
52	16b, 1 = 1	Main voltage V1-W1	190.07	158.153	Data I/O 53
53	16b, 1 = 1	Main voltage W1-U1	190.08	158.154	Data I/O 54

Data I/O registers 54 ... 57 programmed for FIO-11 when used for measuring solar irradiation and temperatures:

Holding register	FbEq (16b/32b), scaling	Description	Mirrored inverter parameter	Config Parameter	Name
54	16b, 10 = 1	PT sensor temperature	117.01	158.155	Data I/O 55
55	16b, 10 = 1	Temperature 2	117.02	158.156	Data I/O 56
56	16b, 1 = 1	Irradiation 1	117.05	158.157	Data I/O 57
57	16b, 1 = 1	Irradiation 2	117.06	158.158	Data I/O 58

Data I/O register 58 ... 59 programmed for inverter control commands:

Holding register	FbEq (16b/32b), scaling	Description	Mirrored inverter parameter	Config Parameter	Name
58	16b	Fault reset	131.11	158.159	Data I/O 59
55	16b	Control board boot	196.08	158.160	Data I/O 60

Data I/O registers 60 ... 69 free for user configuration:

Holding register	FbEq (16b/32b), scaling	Description	Mirrored inverter parameter	Config Parameter	Name
60		None	-	158.161	Data I/O 61
61		None	-	158.162	Data I/O 62
62		None	-	158.163	Data I/O 63
63		None	-	158.164	Data I/O 64
64		None	-	158.165	Data I/O 65
65		None	-	158.166	Data I/O 66
66		None	-	158.167	Data I/O 67
67		None	-	158.168	Data I/O 68
68		None	-	158.169	Data I/O 69

■ Error code registers, 89-99

The error code registers can be read to find out why a Modbus read/write operation fails with code 0x04. The registers contain additional information on failing query. The internal error register is cleared when a query has finished successfully.

Ref	Name (all profiles)	Description
89	Reset Error Registers	Reset internal error registers (registers 91...95). 0 = do nothing 1 = reset
90	Error Function Code	Function code of the failed query
91	Error Code	This error code is set when the device responds with an error code of 4 (Device Failure). 0x00 – No error 0x02 – Low/High limit exceeded 0x03 – Faulty Index - access to an unavailable index of an array parameter 0x05 – Incorrect Data Type - value does not match the data type of the parameter 0x65 –General Error - Undefined error when handling a Modbus query
92	Failed Register	The last register that failed to be read or written. This register can be any of the following: discrete input, coil, input register, or holding register.
93	Last Register Written Successfully	The last register that was written successfully. This register can be any of the following: discrete input, coil, input register, or holding register.
94	Last Register Read Successfully	The last register that was read successfully. This register can be any of the following: discrete input, coil, input register, or holding register.
95-99	Not used	

■ Read/write registers, 100-65535

The Modbus interface can be set up to use one of several addressing schemes (modes) for accessing the configuration and control parameters of the inverter. The addressing modes are described below. The parameter *158.33 Addressing mode* selects the addressing scheme the Modbus interface uses.

- Mode 7 - default addressing mode. All register data transactions are 32-bit wide. All 16-bit parameters of the inverter can also be read/written in this mode. However, the Modbus master must specify the number of registers as two (2) whenever a 16-bit parameter is to be written or read.
- Mode 1 - addressing mode that can only handle 16-bit parameters. Note that many of the parameters of the inverter cannot be accessed by this mode.

- Mode 6 - supports both individual 16- and 32-bit parameter read/write operations. Note that only parameter groups up to 199 can be accessed using addressing mode 6.

Addressing mode	
Mode 1	This mode can access the 16-bit value of any parameter in the inverter. (16-bit values, groups 1...255, indexes 1...255) RegisterAddress = 256*ParamGroup + ParamIndex - 1
Mode 6	This mode can access both 16-bit and 32-bit values of parameters. (16-bit values, groups 101...199, indexes 1...99) RegisterAddress = 100*(ParamGroup – 100) + ParamIndex - 1 (32-bit values, groups 101...199, indexes 1...99) RegisterAddress = 20000 + 200*(ParamGroup – 100) + 2*ParamIndex – 1
Mode 7	(32-bit values, groups 101...227, indexes 1...255) RegisterAddress = 512*(ParamGroup – 100) + 2*ParamIndex - 1

■ Modbus function codes

The following table describes supported Modbus function codes.

Function	Code (hex)	Supported subcodes
Read Coil Status	0x01	N/A
Read Discrete Input Status	0x02	N/A
Write Single Holding Register	0x06	N/A
Read Multiple Holding Registers	0x03	N/A
Force Single Coil	0x05	N/A
Diagnostics	0x08	• 0x00 – Query – echo/loopback testing • 0x01 – Restart – restart and initialize the EFB. This is the only command that brings the device out of the listen-only mode. • 0x04 – Force Listen Only • 0x0A – Clear Counters • 0x0B – Read Bus Message Count • 0x0C – Read Bus CRC Error Count • 0x0D – Read Bus Exception Count • 0x0E – Read Slave Message Count • 0x0F – Read Slave No Response Count • 0x10 – Read Slave NACK Count • 0x11 – Read Slave Busy Count • 0x12 – Read Bus Overrun Count • 0x14 – Clear Overrun Counter
Get Comm. Event Counter	0x0B	N/A
Force Multiple Coils	0x0F	N/A
Write Multiple Holding Registers	0x10	N/A
Mask Write Register	0x16	N/A

Function	Code (hex)	Supported subcodes
Read/Write Multiple Holding Registers	0x17	N/A
Encapsulated Interface Transport	0x2B	0x0E – Read Device Identification – Allows reading identification and other information. Supported "Read Device ID Codes" (access type): • 0x00 – Request to get the basic device identification (stream access) • 0x04 – Request to get one specific identification object (individual access) Supported Object IDs: • 0x00 – Vendor Name – "ABB" +"Serial No" + "Sw Version" + "Modbus Protocol ID" • 0x01 – Product Code – "Serial Number" • 0x02 – Major Minor Revision – " Firmware Version" + " Modbus Protocol ID" • 0x04 – Product Type "PRO-33.0-TL-OUTD-SX400"

Product name and serial number

The product name and serial number can be read through the Modbus interface. This chapter describes the coding of the name and serial number.

The product name and serial string is obtained by concatenating the complete range of parameters. Each parameter is a 32-bit word holding 4 ASCII characters, one per byte. The ASCII is read from MSB to LSB of the 32-bit parameter.

For example, the parameter *107.30 Product name1* should contain the value:

1347571501 (decimal)

50524F2D (hex)

The four hex bytes translate into ASCII:

• 50 = 'P'

• 52 = 'R'

• 4F = 'O'

• 2D = '-'

that is, PRO-".

Device identification information can also be read with the Modbus function code 0x2B/0x0E. This is described in more detail in chapter *Modbus function codes* on page *106*.

The table below describes the product name and serial number requester mapping when addressing mode 7 is used.

Register	Description
3644	Product Name 1 (ASCII) 4char
3646	Product Name 2 (ASCII) 4char
3648	Product Name 3 (ASCII) 4char
3650	Product Name 4 (ASCII) 4char
3652	Product Name 5 (ASCII) 4char

Register	Description
3654	Product Name 6 (ASCII) 4char
3656	Product Name 7 (ASCII) 4char
3664	Serial number 1 (ASCII) 4char
3666	Serial number 2 (ASCII) 4char
3668	Serial number 3 (ASCII) 4char
3670	Serial number 4 (ASCII) 4char
3672	Serial number 5 (ASCII) 4char
3674	Serial number 6 (ASCII) 4char
3676	Serial number 7 (ASCII) 4char

Modbus RTU examples

The examples below describes how to access the configuration parameters of the inverter using Modbus RTU.

Default Modbus RTU settings are used.

Note: Changes made to Modbus configuration parameters are effective only after selecting *Refresh settings* in parameter *158.06 Comm control*.

Parameter	Name	Description	Default value
158.01	Protocol enable	Shows status of embedded Modbus RTU protocol. This parameter is read-only parameter. To change the operational status, see parameter *149.21*.	Modbus RTU
158.02	Node address	Defines address for the inverter on RS485 bus.	1
158.04	Baud rate	Selects the communication speed of the RS485 bus	19.2 kbps
158.05	Parity	Defines the character framing for the RS485 bus.	8 NONE 1
158.07	Comm diagnostics	Bit field coded diagnostic parameter for trouble shooting. For idle operation the bit pattern should read: 0000 xx01 1000 0000 With relative fast polling of the inverter the bit pattern typically reads: 0000 xx00 0000 0000 x = don't care	-

Parameter	Name	Description	Default value
158.33	Addressing mode	Defines mapping between parameters and holding registers in the upper Modbus register range (101...65536). **Note**: This mode • supports 32-bit access only. • always requires two holding registers requested in the read/write Modbus command. • supports reading/writing of 16-bit inverter parameters. For addressing mode 7, parameter group and index are converted to Modbus holding address using the following formula: $RTUregister = 512(ParamGrp - 100) + 2(ParamIndex) - 1$ Example: In parameter index (*ParamIndex*) 101.01, digits 101 is the parameter group (*ParamGrp*)	Mode 7
158.34	Word order	Selects word order when 32-bit parameters are transferred. Default is Lo-Hi i.e. low order word is sent first on the wire.	Lo-Hi

Example 1. Read parameter 101.01 DC voltage.

```
Node address = 01
Function code = 03
Holding register address = 512*(101-100) + 2*1 -1 = 513 (0x0201)
Registers to read = 02
Modbus master TX: 01 03 02 01 00 02 94 73
Modbus master RX: 01 03 04 FE D7 00 00 7B E3
Reply value = 0xFED70000 -> swap words -> 0x0000FED7 = 65239 ->
652.39 V
```

Example 2. Write parameter 130.75 External power limit.

Set external power limit = 75%

```
Node address = 01
Function code = 10
Holding register address = 512*(130-100) + 2*75 -1 = 15509 (0x3C95)
Value to write = 75 -> 0x4B -> swap words -> 0x004B0000
Registers to write = 02
Modbus master TX: 01 10 3C 95 00 02 04 00 4B 00 00 4B EB
Modbus master RX: 01 10 3C 95 00 02 5D B4
```

Example 3. Read Data I/O registers 4 to 10.

These registers are a subsection of the registers normally read by the VSN-700 logger. The registers are in a contiguous row of registers and can be read with one read operation. Start address equals 0x03. See mapping in section "Data I/O registers, 0-68".

```
Node address = 01
Function code = 03
Holding register address = 03
Registers to read = 07
Modbus master TX: 01 03 00 03 00 07 F4 08
Modbus master RX: 01 03 0E 19 7A 01 15 13 88 00 C0 00 C0 00 00 00
64 DE 53
Reply:
  Data I/O 4  = 0x197A -> DC voltage      6552 -> 652.2 V
  Data I/O 5  = 0x0115 -> Line current     277 ->  27.7 A
  Data I/O 6  = 0x1388 -> Frequency       5000 ->  50.00 Hz
  Data I/O 7  = 0x00C0 -> Apparent power   192 ->  19.2 A
  Data I/O 8  = 0x00C0 -> Power            192 ->  19.2 A
  Data I/O 9  = 0x0000 -> Reactive power     0 ->   0.0 A
  Data I/O 10 = 0x0064 -> CosPhi           100 ->   1.00
```

Example 4. Write Data I/O register 1

This register is predefined and mapped to the internal parameter *189.9 Inverter operation*.
See mapping in section *Data I/O registers, 0-68* (page *102*). Writing a zero into this
register disables the inverter.

```
Node address = 01
Function code = 06
Holding register address = 0
Registers to read = 01
Modbus master TX: 01 06 00 00 00 00 89 CA
Modbus master RX: 01 06 00 00 00 00 89 CA
```

6

Tools

Contents of this chapter

This chapter describes the PC tools that can be used with PRO-33.0-TL inverter. These tools may be used in commissioning, troubleshooting and service activities. All the tools require a PC running the Windows operating system.

■ Drive composer entry

Drive composer entry is a basic startup and maintenance tool. With this tool, it is possible to adjust and monitor parameters with a single inverter through a point-to-point connection. Drive composer entry can be downloaded for free from the ABB website.

■ Drive composer pro

Drive composer pro is an enhanced version of the Drive composer entry tool. In addition to all the features in the entry level version, it supports multiple inverters through the tool network and fast monitoring of inverter signals. Drive composer pro is available through the ABB sales channels.

7

Firmware update

Contents of this chapter

This chapter describes how to update the inverter firmware as well the firmware of the control unit. For both update tasks a PC computer with the Windows operating system and an USB port is required.

See,

- *Updating inverter firmware* (page *114*)
- *Updating control unit firmware* (page *119*)

Updating inverter firmware

This chapter describes how to update the PRO-33.0-TL inverter firmware. Firmware is downloaded to the inverter via the control unit. The control unit connects the inverter to a host PC using a standard USB cable.

Safety

Before proceeding with the firmware update, refer to the PRO-33-TL inverter product manual for all safety notifications. Perform installation and maintenance work in accordance with the instructions in the product manual.

Prerequisites

Following items are required to update the inverter firmware:
- USB cable (USB to Mini-USB)
- Drive loader 2 tool
- Firmware loading package
- Tools to open inverter cover

Update process

The update process has three different phases: preparation, firmware download and confirmation of inverter operation.

■ Preparing before firmware update

Backing up inverter data

Execute this step if any modified parameter settings, e.g. Modbus node Id or energy production data are needed to be restored after uploading the software.

To back up inverter data:

1. On the control unit, access the **Main** menu.

2. Select **Backups.**

3. Select **Create backup.**

Disabling the inverter

Disable normal inverter operation before starting the software upload:

1. On the control unit, access the **Main** menu.

2. Select **Service.**

3. Edit **Inverter operation selection** and set the value to **Disable** and press **Save.**

Connecting PC and inverter

Connect the PC and the PRO-33.0-TL-OUTD inverter with an USB cable. The control unit displays the text **USB connected**.

■   **Downloading firmware**

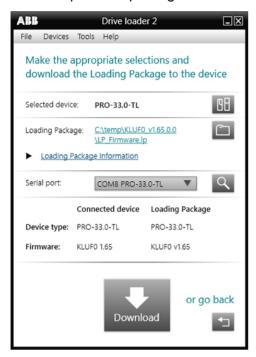To download new firmware to the inverter:

1.   Start the Drive loader 2 program.

2.   Click the **Open a Loading Package to download** button.

3.   Browse to your loading package folder, select the **LP_Firmware.lp** file and select
     Open.
     The tool opens the package and scans the COM ports of your computer.

4.   Verify that correct loading package is opened (file location and firmware version).

5.   Select the correct serial port that says PRO-33.0-TL.

6.   Click the **Download** button.

7.   Select **OK** to proceed.

8.   Downloading starts and status bar is shown.

9.   When the download is finished, the following display is shown.

10. Select **OK** to finalize the download.

■ **Confirming inverter operation**

Inverter settings are restored and the proper operation of the inverter is confirmed.

After downloading the firmware:
- Remove the USB cable from the control unit. The control unit will reboot itself.
- Select the language and go through the first start assistant.
- In case the control panel does not reboot itself and does not resume normal operation, it is recommend to power cycle (disconnect both AC and DC supply) the inverter.

■ **Restoring backup**

Configuration data and energy production data can be restored after a firmware update operation if a backup was created before the update process.

To restore data from a backup:

1. Turn off inverter operation.
   - Enter the **Main** menu.
   - Select **Service.**
   - Edit **Inverter operation selection** and set the value to **Disable** and press **Save.**

2. Restore Backups.
   - Access the **Main** menu.
   - Select **Backups.**
   - Select desired backup file from the list. The list holds a maximum of two files. The file name contains the time stamp for when the file was created.
   - Select **Restore all**,
   - Wait for the restore process to finish.

3. Enable the inverter from the service menu (see step 1).

■ **Firmware loading troubleshooting**

This chapter gives troubleshooting assistance for the firmware update process.

Case 1 - Inverter is running

If the Drive loader 2 reports **inverter is running** error:
- Disconnect the USB cable.
- Enter the **Main** menu.
- Select **Service**.
- Edit **Inverter operation selection** and set the value to **Disable** and press **Save**.
- Connect the USB cable and restart the download.

Case 2 - cable not connected

If the Drive loader 2 reports **fails to communicate with the inverter** error:
- Make sure USB cable is connected.
- Make sure inverter is powered.
- Restart the download.

Case 3 - no devices found

If the Drive loader 2 reports **no connected devices found** error:
- Make sure that the USB cable is connected.
- Make sure that the inverter is powered.

Case 4 - communication fails

If the Drive loader 2 reports **Serial port login failed the serial port is available but inverter is not able to communicate** error:
- Make sure that the cable is connected and the inverter is powered.
- Restart the download.
- If this does not help, reboot the inverter and restart the download.

Case 5 - Rating ID mismatch

If the inverter, after firmware update, reports **24069 Rating ID mismatch** error:
- Re-boot the control board with parameter *196.08 Control board boot* or
- Power cycle the inverter.

Case 6 - Internal SSW faults

If the inverter, after firmware update, reports **Internal SSW faults** error:

This error can be ignored. The log entry is created during the update process and does not signify a real error. You can clear the event log with parameter *196.51 Clear fault and event logger*.

Updating control unit firmware

This section describes how to update the firmware of the PVS-AP-L control unit. An ordinary (windows) PC can be used for uploading host.

Note:
- It is possile to update the control unit without mounting it inside the inverter. In standalone mode the control unit is powered from USB and the update process remains the same.
- Firmware upgrade requires approximately four minutes to complete.

Preparation

Make sure of the following, before starting the update process:
- download and unzip the loading package (e.g. KPAPP_v5.02 _UpdatePackage.zip).
- If the PC is running on battery power, check that there is sufficient battery power to keep the PC running normal throughout the update process.
- If this is the first time the host PC is used for updating the PVS-AP-L control unit, install the proper USB drivers for the control unit.

    Note: The USB drivers are included in the KPAPP SW (zip file). USB drivers are also installed with the Drive loader 2 tool.

Updating firmware

1. Connect the mini-USB connector to the control unit. If the correct USB drivers are installed, the host PC will find the control unit automatically.

2. Double-click on the loader executable, DLoaderWin32.exe,to start the loader.

3. The DLoaderWin32.exe automatically finds the connected control unit.

4. In the DLoaderWin32.exe dialog box, press **Open** and browse to the installation file KPAPP_v4.90.200.2_Update.dlp

5. Press **Load SW** to start the loading sequence.

6. The load process proceeds automatically from start to end.

7. The DLoaderWin32 tool can be terminated when the progress bar indicates that it is 100% uploaded.

8. Unplug the mini-USB cable from the control unit.

9. The control unit reboots and establishes connection with the inverter firmware.

■ **Troubleshooting the control unit**

If the software update terminates prematurely or shows an error message (the message appears below the progress bar in the DLoaderWin32 window), execute the following recovery and reattempt procedures.

Reattempt option 1, restart update procedure

1. Make a note of the fault/error message.

2. Terminate the DLoaderWin32 tool.

3. Disconnect (USB) the Control unit from the PC.

4. Start all-over and make a re-attempt to update the firmware as described in previous sections.

Reattempt option 2, update via cold reboot of the Control unit.

1. If the inverter is powered On, the control unit is also powered from the inverter.
   To do a cold reboot, remove the control unit need from the inverter.

2. Disconnect (USB) the Control unit from the PC.

3. Push the lever at the bottom of the control unit (located beneath the micro USB connector) and pull the control unit to remove it.

4. Disconnect momentarily the RJ45 cable from the back of the control unit.

5. Replace and lock the control unit.

6. Re-attempt to update the firmware.

Forced update, put the control unit in forced update mode

1. If the control unit is not responding or the screen is completely blank, force the control unit into update mode.

2. Remove the USB cable.

3. Remove the control unit from the inverter.

4. Start and open the loading package in DLoaderWin32.

5. Press and hold down the left soft key (above the indicator LED)

6. Connect the USB cable (with constantly pressing the soft key)

7. Press the **Load SW** button on DLoaderWin32 and wait until the progress bar starts to advance. Then release the soft key.

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