Module Description

PROCONTROL 08
Power Supply
Power Supply Module for Generation of Station Supply Voltages
89 NG03

GKWE 705 313 E, edition 07.88

Application

The power supply module 89 NG03 is used for switching and generating the voltages required in a station bus subrack of a PROCONTROL multi-purpose processing station. Since each module subrack has its own voltage supply, the power supply devices are used altogether 4 times for the multi-purpose processing station.

The printed circuit board 89 IL01, although a self-contained module, is a permanent accessory to the power supply module 89 NG03. It is provided with a row of connectors for connecting cables and for forming a support point (see module description GKWE 705 445).

Features

The power supply module is fed via a plug on the front panel. The process voltage US = +24 VDC is switched depending on the internal voltage UD. The process voltage UV = -24 VDC, the reference conductor Z, the annunciation and flashing voltage are only connected through the module.

The voltages UB+ = +24 VDC and UD+ = +5 VDC (with reference conductor ZD) on the bus side and required by the modules are generated via DC/DC converters and are potential-isolated.

Caution:
The module must not be plugged or withdrawn when live, in order to prevent destruction.

The voltages US, UB+ and UD supplied to the station bus are monitored by the module. In the event of a disturbance, an annunciation and/or switchoff takes place.

Voltage supply

The following description of the essential functions of the module refers to the function diagram.

Feed in

The module is supplied with the system voltages USE (+24 VDC) and UV (-24 VDC) together with the reference potential Z via the connector X1. The power supply (USE,Z) takes place twice (once for the output US, once for UB, UD) in order to keep the voltage drop in the supply line to a minimum. The five-pole connector is located on the front of the module.

The annunciation voltages UM and UMM as well as the flashing voltages BLL1, BLS1 and BLN1 are connected via the connector X3 on printed circuit board 89 IL01. The power supply module receives the voltage UMM (see "monitoring") via an auxiliary connector.

Preparation of the station bus voltages

The positive voltage USE supplied via the connector X1 is switched by the power supply module as a process voltage US to the station bus backplane via a switching stage (see "Monitoring"). This voltage is fused in the module. The fuse is located on the front of the module.

The negative voltage UV is supplied directly to the station bus backplane without a fuse and without a switching stage. This also applies to reference conductor Z which is shared by US and UV.

The modules on the station bus, however, additionally require the voltages UB+ = +24 VDC and UB+ = +5 VDC on the bus side with the common reference conductor ZD.

These voltages are generated potential-isolated by the power supply module 89 NG03. The module has a DC/DC converter with two separate outputs, which is supplied with a positive power supply voltage USE. The voltage UB+ (+24 VDC) is sent to the backplane via a switching stage (see "Monitoring"). The voltage UD (+5 VDC) is sent directly to the backplane. ZD is the common reference conductor for UB and UD.

The voltages UB and UD are regulated as a function of UD. The voltage UB is variable, i.e. the output voltage is changed within the permissible limits depending on UD and the connected load.

The module has an internal and external tap for the actual voltage value. If the sensor line is open the voltage UD is controlled to a fixed value on the module output terminals, irrespective of the connected load. If the sensor line is connected (F+, F-), the output voltage on the connection point of the sensor line is controlled to a constant value.

With PROCONTROL, the sensor line is connected in the middle of the station bus backplane. In this way, voltage drops in the supply line caused by changes in the load current (e.g. by plugging in an additional module) are stabilized.
Monitoring

The outputs US and UB are monitored for undervoltage and the output UD is monitored for overvoltage and undervoltage. If the monitoring facility responds, there is an annunciation (see "Annunciation functions"). US and UB are tapped from the module output voltage, whereas UD is tapped from the sensor line F.

In addition to the monitoring of voltages with purely an annunciation function, the module also has an overvoltage and undervoltage monitoring facility with switchoff function.

The following switchoff modalities are provided here:

a) Undervoltage of UD +:
   When USE is switched on a monitoring period of 15 ms is started as soon as UD + exceeds 0.66 VDC. If 4.8 VDC has not been reached after this time, UD + is switched off. If UD + falls again below 0.66 VDC, a new start operation is performed. The module is also switched off if the voltage falls below 4.5 VDC during operation. When the monitoring section responds (disconnection of UD +), the voltages UB + and US are also switched off via the appropriate switching stages and the RST output (reset signal) is set to "0".

b) Overvoltage of UD +:
   Two cases must be differentiated here:
   - If the voltage falls below 5.9 VDC ± 0.1 VDC on the sensor line, the module is switched off (also UB + and US) and is restarted after the voltage has fallen below 0.66 VDC. If UD + then exceeds 5.9 VDC once more, there is a pulse action as with a).
   - If 6.25 VDC (5.9 ... 6.6 VDC) on the module terminals is exceeded, a short-circuit thyristor is triggered and the module (also UB + and US) is switched off. The module can only then be restarted by switching the power supply voltage USE off and on.

The overvoltage monitoring facility can be switched off by means of a plug-in jumper on the contacts 1 and 2 of connector X7 on the printed circuit board 89 IL01. In this case, the following applies:

Monitoring active: Jumper AG1 to AG2 not plugged in
Monitoring inactive: Jumper AG1 to AG2 plugged in

c) Overvoltage of UB +:
   If the voltage UB + exceeds 28 ... 29.5 VDC, the module is also switched off (also US and UD +). Also here, the power supply USE must be switched off and on in order to restart the module.

d) Switchoff function
   The module can be switched off and on externally by means of a switch on the terminal AS1 and AS2.
   Contact AS1 — AS2 closed: "Module off".
   Contact AS1 — AS2 open: "Module on".
   The terminals are located on the printed circuit board 89 IL01, terminal strip X7, terminal 3 + 4.

e) Overvoltage USE
   If the input voltage USE exceeds USE 45 VDC, the entire converter is switched off until the input voltage USE is below 40 VDC. The function is designed to prevent the module from being destroyed in the event of an extreme input voltage.

Test functions

Two sockets US11 and Z are located on the front of the module. A positive voltage of 24 VDC can be tapped from them for testing purposes. This voltage is protected by a fuse on the front of the module.

Annunciation functions

Annunciations on the module

Two green light emitting diodes are located on the front of the module.

The light emitting diode emits a steady light for as long as the voltage US is above 18 ... 20 VDC. It is set back if the monitoring facility detects a fall below this value.

The light emitting diode UB/UD emits a steady light for as long as both voltages are within the permissible range. It is set back as soon as one or both voltages fall below the permissible range.

Annunciations from the module

Both monitoring facilities for US and UB+/UD+ receive the annunciation voltage UMM for their annunciation contacts. If the monitoring facilities respond, the annunciation signal MSP is output as a general annunciation.

In addition, the RST signal is output from the monitoring facility for UB+/UD+. The output RST shows "0" if the voltage UD ≤ 4.5 VDC and maintains this condition until at least UD ≤ 0.6 VDC. The voltage drop across the switch is ≤ 0.4 VDC with a current of 3.5 A.

The voltage UD+ = +5 VDC is switched to ZD = 0 V by means of the RST signal via a resistor of 1.8 Ω on the printed circuit board 89 IL01.
Function diagram

X1: Front connector at Module 89 NG03
X2, 3, 4, 6, 7: Connectors on PCB 89 IL01
Mechanical design

Board size: 6U 5T, (20 x 5.08), 220 mm deep with PCB 89 IL01

Connectors

for X1 (front): Pin connector, 6-pole, Burndy, type ME 6P2 GEO1

for X2 (rear): to DIN 41 612
15-pole, edge connector type H; special design with increased current load capacity

for lower auxiliary connector (rear): to DIN 41 612
32-pole, edge connector type C

Test socket (front): 2 mm, black

Fuse links for fine-wire fuses: 5 x 20 mm

Weight: approx. 4.6 kg

View of front panel

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Do not plug in or withdraw when voltage is present

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Technical data

Input values

Rated voltage
USE = + 24 VDC
UV = - 24 VDC

Z reference potential
Operating range
18.0 ... 33 VDC
Destruction voltage limits
0.5 sec 35 VDC
10 ms 45 V
Disturbance pulses with a time integral ≤ 500 µs are permissible.

Output values

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>UD + 5 VDC</th>
<th>UB + 24 VDC</th>
<th>US + 24 VDC</th>
<th>UV - 24 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference potential</td>
<td>ZD</td>
<td>ZD</td>
<td>Z</td>
<td>Z</td>
</tr>
<tr>
<td>Tolerance static for $I_N$</td>
<td>4.95 ... 5.05 VDC</td>
<td>23.8 ... 24.2 VDC</td>
<td>USE-2 VDC</td>
<td>= Input voltage</td>
</tr>
<tr>
<td>Ripple</td>
<td>&lt; 100 mVpp</td>
<td>&lt; 100 mVpp</td>
<td>same as for input voltages</td>
<td></td>
</tr>
</tbody>
</table>

Current max.
20 A
3 A
4 A
4 A

Power output max.
Σ 120 W

Influence (input voltage,
Temperature) in load range
0 ... 100 %
< 2 %
< 5 %
—
—

Correction time
< 1 ms
< 1 ms
—
—

Current limitation
yes
yes
fuse
—

Short circuit peak current
$1.2 I_{max}$ at 20 °C
$I_{max}$ at 70 °C

Overvoltage protection
yes
yes
—
—

Potential isolation
yes
yes
—
—

Sensor line
yes
—
—
—

Open-circuit-proof
yes
yes
yes
yes

Short-circuit-proof
yes
yes
yes

Display
LED green
LED green
LED green

Voltage failure dU/dt
(U = 10 ... 90 %)
≥ 500 mV/µs
≥ 2 V/µs
≥ 0.5 V/µs
continuous

Transfer values

Efficiency
USE-US
≥ 0.9
USE-UD,UB
≥ 0.7

Radio interference

to VDE 0875 (< 10 kHz)
Interference level N
Limit value class A

Mains buffering
with 0 ... 100 % load
≥ 1 ms
Overvoltage-proof

- 0.5 s 35 VDC
- 10 ms 45 VDC
- Switch off for $U_{C} > 45$ V
- Disturbance pulses with a time integral ≤ 500 μVs are permissible

Protection

- Fuse for US G 4 A quick-acting
- Fuse for US11 G 0.8 A quick-acting

Special functions

- Switch off of UB and US
- Anti-parallel diode to US and UV
- Load capacity 4 A

Ambient conditions

Ambient temperature
- continuously permissible in operation: -25 °C ... +70 °C
- storage temperature: -40 °C ... +85 °C

Humidity resistance
- to DIN 40 000: Class F

Mechanical strength
- to DIN 40 040: Class Z

Cooling
- Internal convection
  (without fan)

Ordering data

Order number 89 NG03: GJR4 503 500 R1

Technical data are subject to change without notice