Description Energy 3000

Definition of the Output Data

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

Deviation at Load Variation (static)

On all practical applied regulators there is a small change in the regulating variable (voltage, current or power) as a reaction to the change in the load, the so called deviation. In the data sheet it is given as a maximum magnitude of change caused by a load variation between 0% and 100% of the regulated variable.
Measurement is conducted directly on the female connector with sense leads connected at the measuring point.

Deviation in the Event of a Variation in the Mains (static)

If the mains is varied, the regulating variable will also vary slightly (voltage, current or power).
The data sheets specify the maximum system deviation of the regulating variable caused by a change of the mains between V_{inmin} and V_{inmax} .
Measurement is conducted directly on the female connector with sense leads connected at the measuring point.

Residual Ripple (300Hz)

When rectifying the 50Hz AC current, a 300Hz superimposition on the DC voltage results. This 300Hz ripple is measurable as a residual ripple on the output voltage.
Measurement is conducted in voltage regulation mode directly on the female connector with sense leads connected at the measuring point and in current regulation mode directly at the output.

Operating Frequency Ripple

The output voltage of primary switched power supplies is characterised by a small superimposed AC voltage component, the operating frequency ripple. See figure 1.
This results from charging and discharging of the secondary energy stores at the switching frequency.
Values are measured directly on the female connector with sense leads connected.
The value in the data sheet is the peak to peak value $V_{R\,PP}$ as shown in fig. 1.

Superimposed Switching Spikes

Fast current and voltage variations occur when the power transistors are switched on and off. This results in high-frequency transient impulses superimposed on the output voltage of the power supply. See figure 1.
These switching spikes are poor in energy.
The data sheet values are measured directly on the female connector without sense leads with a bandwidth of 20MHz.
They are peak to peak values V_{SPP} as shown in figure 1.

Dynamic Voltage Deviation and Regulation Time

Voltage overshoot and undershoot occur in case of abrupt load variations. See figure 2.
Causes of the voltage deviation (ΔV) are the energy stored in the output circuit and the limited speed of the controller.
The regulation time (Δt) is defined as the time until the output voltage returns to remain within a tolerance band after a load variation. The tolerance band is defined as ± 20mV.
The voltage and current characteristics as a function of time are shown in figure 2.
Values are measured directly on the female connector with sense leads connected at the measuring point.

Fig. 1
Output voltage

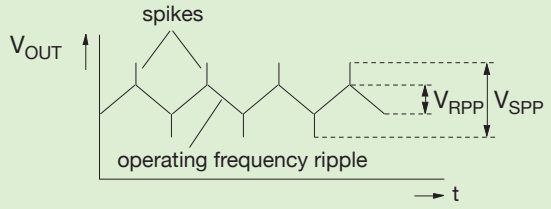
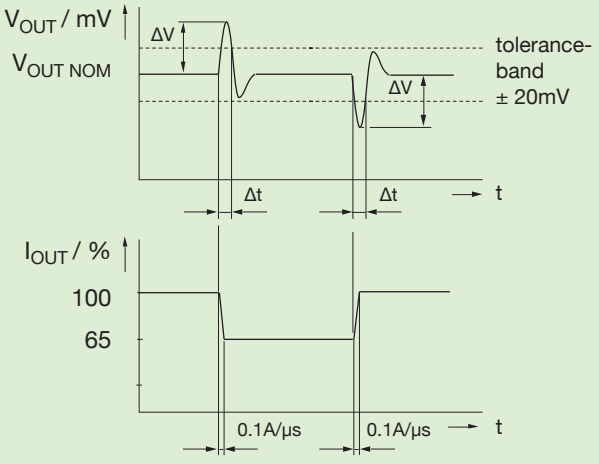


Fig. 2
Voltage variation of the output when subject to a defined sudden load variation



Description Energy 3000

Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

CE
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Initial Operation

Preface

In the following sections, the features of the power supplies of the **energy 3000** series are explained.
The user is provided with the necessary information about how to set up and wire the power supply correctly, as well as about initial operation and operating the power supply.

> Before starting up and operating the power supply, please read the section about electrical safety!
>
> ⚠

Electrical Safety

The contact safety of the housing in the event of an error is only guaranteed if the protective earth in the **mains input connector X1** is correctly electrically contacted.
(Protection class 1 unit)
This requires for example a sufficient conductor cross section and a professional screwable connection (see layout input/output connector).

When wiring the **output leads** in **connector X2** a professional crimping technique and a sufficient cable diameter are required to avoid a risk of overheating and fire (see layout input/output connector).

If the **output is short circuited**, until the current limiter triggers very high currents arise when the output capacitor discharges. The arc formed at the short circuit location can cause hot metal sprays.

The **energy 3000** series provides a voltage at its output terminals which is **electrically isolated** from the mains supply.

In applications above 60Vdc, the user must ensure that the output and load connections as well as the measurement configuration cannot be touched! After switching off mains supply or putting the unit into ”standby”-mode it will take 12 seconds for the output circuit to discharge if no external load is connected to the unit (idle mode).
Please note that the unit is not electrically isolated from the mains supply when the unit is in the **standby mode**. The full mains voltage is still present in the unit. The standby-switch solely causes the power to be switched off from the mains supply to the output side.
If the user wants to electrically isolate the unit from the mains, a separation device must be provided in front of the unit input.
If the output voltage is connected with another earthed voltage the maximum value at the output terminals against earth may not exceed 300Vdc.

For interference free programming operation due to reasons of interference immunity, the interface cable has to be screened and the **screen** is to be referred to **earth** contacted all the way around on both sides.
The **analogue actual values** and **set values** on the X3 interface and the **analogue actual values** on the measurement sockets of the front panel may not be earthed or electrically connected with the load circuit (see fig 4).
The analogue signals of the interface are electrically connected to the negative pole of the output voltage (see fig.4) through a low ohmic sense lead resistor.
If the negative pole is earthed the analogue signals are earthed as well and the contact safety of the programming facility is guaranteed.
In the event of the programming signal accidentally being earthed, the sense lead resistor is bridged and the output voltage is detuned.
If only the sense leads are connected to the load, the current through the sense leads is increased and damage can occur as a result.

These versions are not suitable for being connected in series or a ± connection or for earthing the positive pole.
Please contact us if your application contains one of these points.

Installation and Wiring

When installing the power supply, care must be taken that the lateral air ducts are not covered. The same applies to the air outlet at the back of the unit.
The air quantity per air inlet is approx. 0.66 m^3/min.

When wiring the mains connection X1 and DC output connection X2 the information on electrical safety must be observed. Also see chapter "Pin configuration".

> The power supply does not have a mains switch and is therefore immediately under voltage as soon as the mains input connector is applied with voltage.
> The unit´s connections (mains, output, interface) may only be plugged or unplugged in dead condition. Otherwise the plugs´ contacts may be damaged or destroyed.
>
> ⚠

Delivery Scope

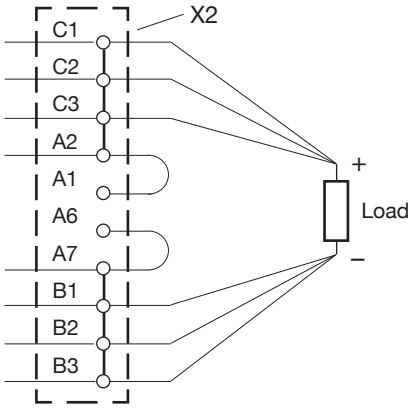
The delivery scope includes a 25 pole D-sub connector with integrated bridges. (See setting, display, operation as well as fig. 3 and allocation of the unit interface.)
The mains cable outlet, the load connector and additional D-sub connectors for individual allocation of the interface are available as accessories.
(See ordering information.)

Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

Operation without Sense Leads:

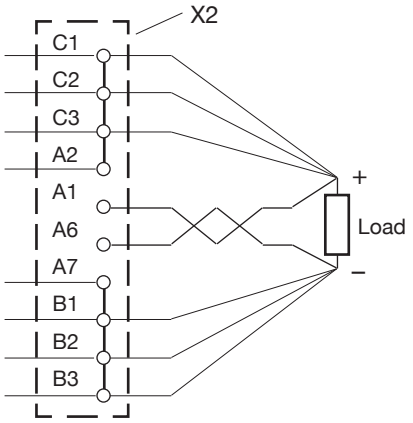
Bridge on output connector X2 (accessory) required in field A from contact A1 to A2 and from contact A6 to A7.



Operation with Sense Leads:

The A1 contact must be connected to the positive pole of the load and the A6 contact to the negative pole of the load. In order to guarantee smooth operation the sense leads should be led to the consumer closely twisted.
Connections A2 and A7 must not be connected to the load!

The load lines may not be disconnected before the sense leads, or the sense leads may not be connected before the load lines, as this will lead to the destruction of the device.



When installing the interface connection X3 the information on electrical safety must be observed.
See chapter "Programming and Interface".

> The analogue set values have to be provided floating and voltage free from the load circuit.
> The analogue actual values must not be earthed or electrically connected to the load circuit.

Due to reasons of interference immunity, the interface cable has to be screened and the screen is referred to earth contacted all the way around on both sides.

Setting, Display, Operation

The unit is delivered with a D-sub connector in order to enable use of the unit without a programming connector to be provided by the customer.
With the connector plugged in the power supply operates as a unit with front panel setting.
As a factory setting the appliance is set to the nominal values for voltage, current and output.
The nominal values and setting ranges are printed on the front panel.
With the potentiometers (1) accessible on the front panel the set values can be changed in the ranges specified.
The set value is increased by turning the set value potentiometer clockwise.
Turning to the left stop means minimum set value and to the right stop maximum set value.
By removing the interface connector, the unit is deactivated.
When producing programming plugs, the user must follow the rules layed out in the chapter "Programming and interface", as well as the safety advises.

The slide switch at the front now has to be set in the ”standby” position or the current of the standby/on-optocoupler has to be interrupted.
Now the three-phase mains supply can be connected by the user.
After a short power-up time the power supply is in the standby-mode and is ready to be released.
If the sliding switch on the front panel is now moved to the ”on” position and the standby/on-optocoupler is supplied with voltage, the unit operates according to the set values which were specified on interface (X3) (see interface description).

> Please note that the power supply is not electrically isolated from the mains supply when the switch is in the standby-mode. The unit is still fed the full mains voltage.
> The standby-switch solely causes the transfer of the power from the mains supply to the output side to be interrupted.

If the actual value of the unit output reaches the set value specified, the controller intervenes and keeps the relevant electrical parameter constant.
Control operation is indicated by a LED (3) on the front panel (see fig. 3).
If the LED (CC) lights up, this signalises that the unit is in current control.
These actual values of the corresponding electrical parameter can be measured at the **monitor outputs** (2) (measurement sockets) and the actual value outputs of the interface.
The values are normalized.
0-5V actual value on the measurement socket corresponds to 0-100% of the output parameter in question (see output characteristics).
For monitor signal deviations see technical data.

Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

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In standard operation one of the three control LEDs (CV, CP, CC) lights up and the fan inside the unit operates.
If the operating point is displaced due to a change in impedance of the load, a change in the type of control can result.
In the transition area it is possible that two control displays light for a short time.

The "remote" LED lights up as soon as a set value is specified through the interface.

Measuring at the measurement sockets must be carried out voltage free from the output and earth.
The measurement configuration must be contact safe. The negative pole of the measurement socket is electrically connected with the minus sense lead.
Also see Chapter ”Electrical Safety” and ”Options”.

Load-Share

The Load-share function provides an active load subdivision, for power supplies in parallel or redundant. The Load share function is active only in voltage regulation mode.
The output current of all parallel (or redundant) connected power supplies, becomes balanced in every load point with an exactness of 10% of the maximum output current. Therefore the LS –pin of all in parallel (or redundant) connected power supplies, has to be connected with each other.

Overvoltage Protection

Thanks to the standard integrated overvoltage protection (OVP) the power supply is being switched off using a second way, independent from the normal control circuit. This state is being stored.
If no energy is being fed from an external source, the output circuit will discharge.
Has the overvoltage protection been triggered by an external overvoltage pulse, normal operation mode of the power supply can be restored by acknowledging the error using either the standby/on switch or the standby/on optocoupler.

Phase Failure

If one of the mains supply phases fails the power supply can be maintained if the power output is 2/3 of the nominal load. At nominal load the unit´s fuses trigger after a few minutes.

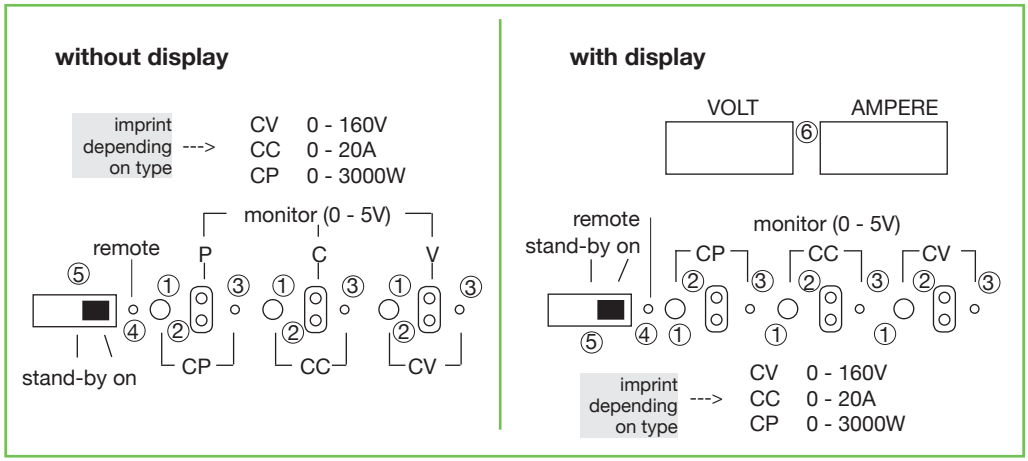
Switching Off

The power transfer from the mains to the output side is switched off using the sliding switch at the front panel, or by interrupting the current of the stand-by/on optocoupler.
For electrical isolation from the supply network the user has to provide a three-phase mains switch in front of the mains input.

Temperature Coefficient

The temperature coefficient indicates the maximum relative change of the output voltage per Kelvin of temperature change.

Fig. 3 Control and display elements on the front panel



① - set value potentiometers
② - actual value measurement sockets
③ - control LED
④ - remote LED - out of order
⑤ - standby/on- switch
⑥ - display

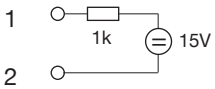
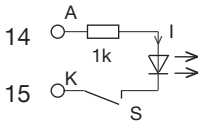
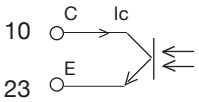
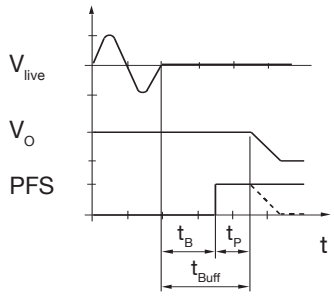
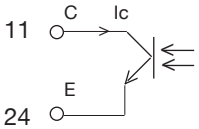
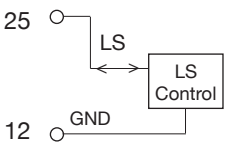
Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

Programming and Interface

The signals of the interface can be differenciated as follows:

1) Auxiliary voltage 15V
2) Optocoupler input (standby/on)
3) Optocoupler output "Power Fail Signal" (PFS)
4) Optocoupler output "Failure Signal" (FS)
5) Parallel switching input/output "Load Sharing" (LS)
6) Set value input V, I, P_{set}/ V, I, $P_{set\ POT}$
7) Actual value outputs V, I, P_{actual}
8) Reference voltage $5V_{ref}$

signal name	pin number/symbol	explanations
15V GND		The 15V auxiliary voltage has an internal resistance of 1kΩ. It can be used to supply the standby/on-optocoupler. The GND is connected with the minus pole of the DC output.
standby/ on		The connections of the optocoupler are floating. If a current flows (2mA ≤ I ≤ 10mA), the unit is “on”. If the current flow is interrupted the unit is in standby-mode. The standby/on-switch on the front panel is in series to the optocoupler and in the standby-mode prevents the optocoupler from functioning. If an error message has been saved (see "Troubleshooting"), the error message can be resetted using the switch on the front panel or the connected optocoupler. Reset: on --> standby (2 sec) --> on.
PFS (Power Fail Signal)		The connections are floating. V_{CEmax} = 50V / I_{Cmax} = 10mA The transistor is blocked in the event of a power failure (PFS).  (t_B, t_P , t_{Buff} see technical data) ---- = when using the internal auxiliary supply (pin 1) —— = when using an external supply
FS (Failure Signal)		The connections are floating. V_{CEmax} = 50V / I_{Cmax} = 10mA The transistor is conductive in the event of an error message. The error message is activated in the case of DC output overvoltage (OVP) or the unit overheating. The message is saved and has to be resetted with the standby/on function on the front panel (switch) or the standby/on optocoupler (see standby/on function).
LS (Load Sharing)		For parallel switched units these pins serve the active load sharing. To this end, LS and GND have to be connected with the pins of the same name of the parallel unit. The number of parallel units is limited to three. The units of the same type balance themselves in the voltage control operation to 10% of the nominal current. (Also see interface switching on the following pages) The GND is connected with the minus pole of the DC output.

Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

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signal name	pin number/symbol	explanations
V_{set}	16 V_{set} 3 GND	Entry of voltage set value 0… 5V corresponds to 0… 100% V_A
I_{set}	17 I_{set} 4 GND	Entry of current set value 0… 5V corresponds to 0… 100% I_A
P_{set}	18 P_{set} 5 GND	Entry of power set value 0… 5V corresponds to 0… 100% P_A
$V_{set\ POT}$	8 $V_{set\ POT}$ 3 GND V	Setting the voltage set value through the front potentiometer If pin 8 is connected with pin 9 (5V) the voltage set value is set on the front potentiometer. (V_{set} may not be assigned in this case.)
$I_{set\ POT}$	21 $I_{set\ POT}$ 4 GND I	Setting the current set value through the front potentiometer If pin 21 is connected with pin 9 (5V) the current set value is set on the front potentiometer. (I_{set} may not be assigned in this case.)
$P_{set\ POT}$	22 $P_{set\ POT}$ 5 GND P	Setting the power set value through the front potentiometer If pin 22 is connected with pin 9 (5V) the power set value is set on the front potentiometer. (P_{set} may not be assigned in this case.)
V_{actual}	6 V_{actual} 20 GND	Actual voltage value output 0… 5V corresponds to 0… 100% V_A
I_{actual}	19 I_{actual} 20 GND	Actual current value output 0… 5V corresponds to 0… 100% I_A
P_{actual}	7 P_{actual} 20 GND	Actual power value output 0… 5V corresponds to 0… 100% P_A
$5V_{ref}$	9	5V reference I max = 5mA
	13 nc	This connection may not be assigned.

Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

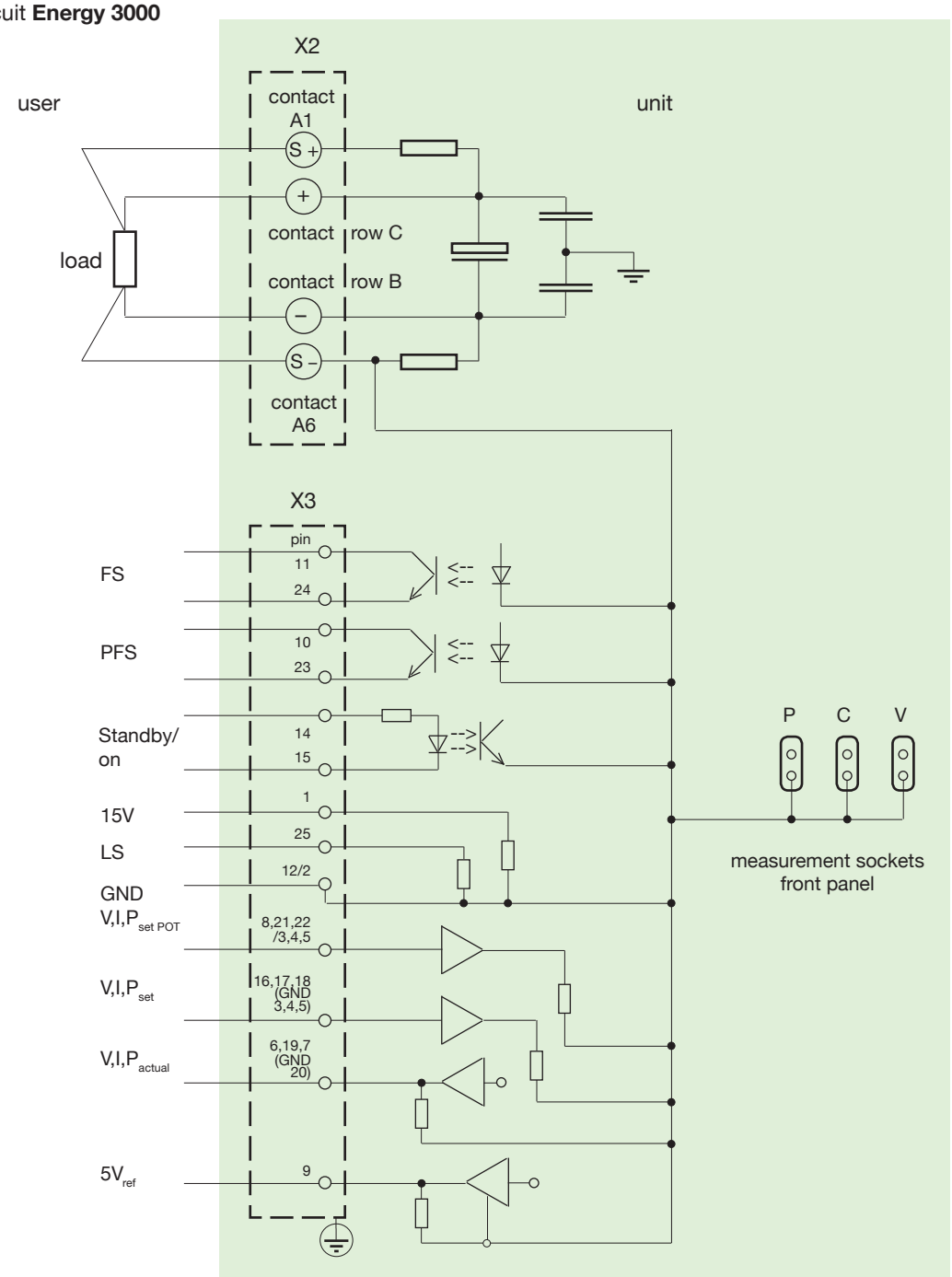
On delivery, a connector is provided with the D-sub unit socket, which contains the necessary bridges to activate the set value specification through the front panel (8-->9, 21-->9, 22-->9) and switch the device on (1-->14, 2-->15). The power supply then operates with a set value specified on the front panel.

If this connector is removed the unit is ready for external interface connection.
The programming operation is indicated by the front panel "remote" LED as soon as a set value is specified through the interface.
The analogue signals of the interface refer to the DC output.

Due to this reason, the analogue set and actual values have to be provided floating and voltage free from the load circuit and processed further in this manner.

Please observe the information on electrical safety and the connection of the signal ground (GND) to the negative output pole, see fig. 4.

Fig. 4 Output Circuit **Energy 3000**



Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

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Interface Connection X3

D-Sub Socket 25 pole

Application examples and wiring of the D-sub interface X3.

Example 1

(Individual operation V-programmed)

Voltage (V_{set}) is specified externally, current and power are set on the front panel.
The unit is switched on and off through a floating contact.
The voltage and current actual values are monitored.

Example 2

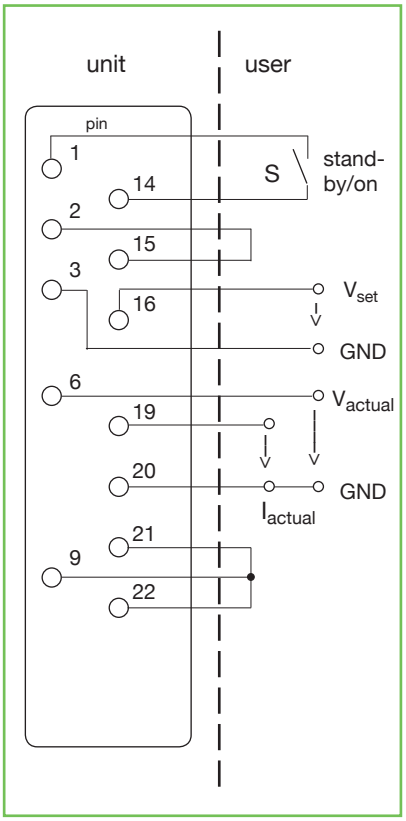
(Individual operation V, I-programmed)

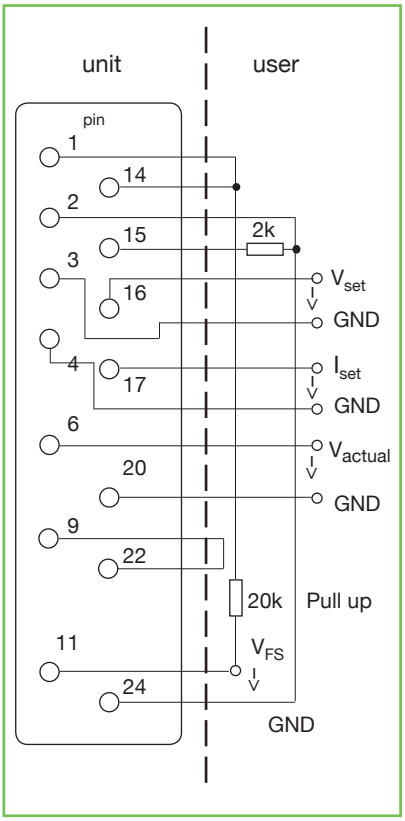
Voltage (V_{set}) and current (I_{set}) are specified externally, power is set on the front panel.
The unit is permanently switched on.
The voltage actual value is monitored.
In the event of an error V_{FS} is < 1V otherwise > 8V.

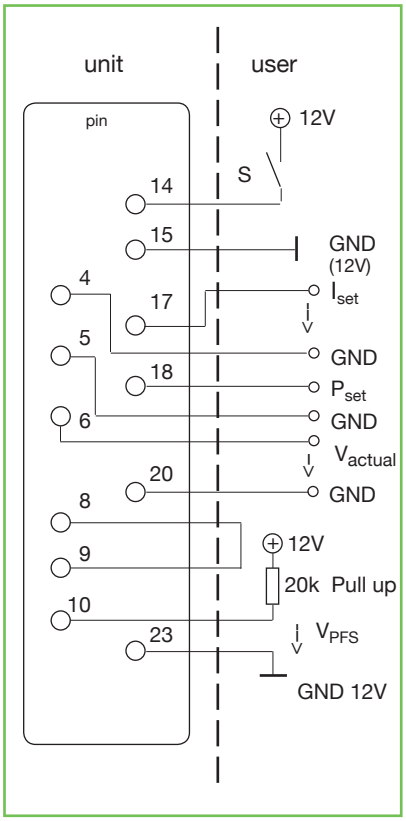
Example 3

(Individual operation I, P-programmed)

Current (I_{set}) and power (P_{set}) are specified externally. The voltage is monitored. The unit is switched on by the customer with a external voltage (12V) and a floating contact.
V_{PFS} > 8V in the event of a mains failure, < 1V for mains ok.







Applications

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

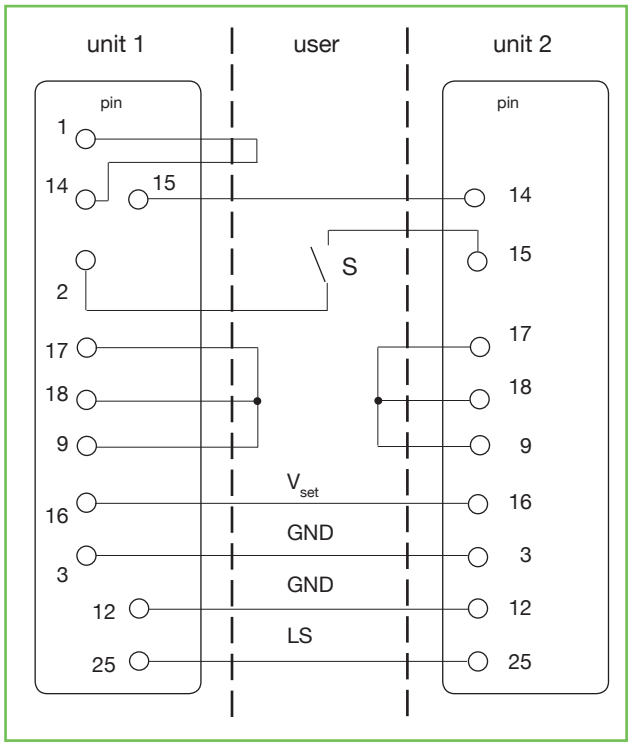
Interface Connection X3

D-Sub Socket 25 pole

Application examples and wiring of the D-sub interface X3.

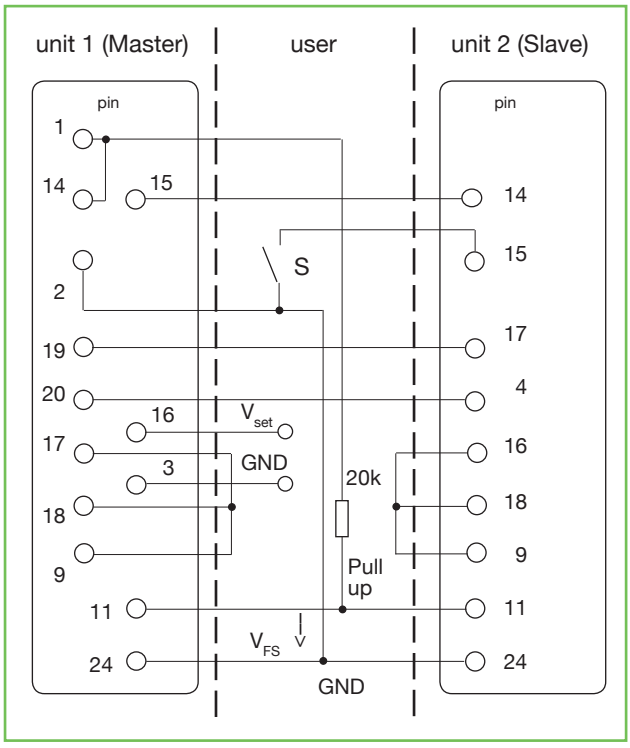
Example 4 (parallel operation multi master)

V_{set} is specified externally on units 1 and 2. The units are switched on together through a floating contact S. The units are balanced in load sharing.



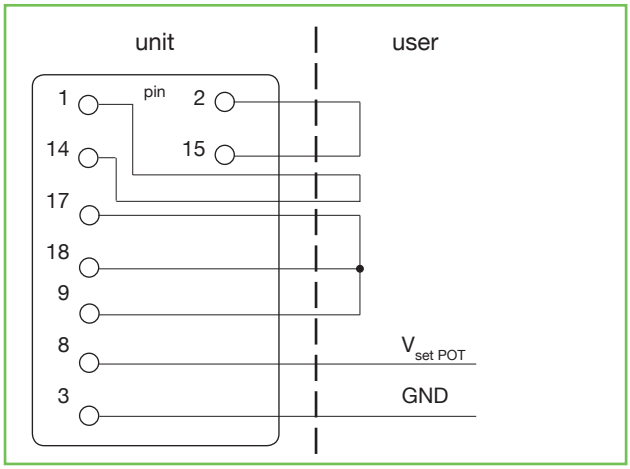
Example 5 (parallel operation master slave)

Contact S switches both units on.
V_{set} is specified on unit 1.
I_{actual} of unit 1 controls I_{set} of unit 2 (slave).
In the case of unit 1 I_{set}/P_{set} are maximum values.
In the case of unit 2 V_{set}/P_{set} are maximum values.
Due to the parallel switching of the "FS" signals a collective error message is possible.
V_{FS} < 1V = error message.
V_{FS} > 8V = no error message.



Example 6 (individual operation with front panel adjustment)

The power supply is permanently switched on.
I_{set}, P_{set} are maximum values.
$V_{set\ POT}$ is specified externally and adjusted on the front panel potentiometer on site.



Description Energy 3000

Troubleshooting

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

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Troubleshooting

The power supply has an internal temperature cut-off and an over voltage protection (OVP).
In both cases the power supply is put in the standby-mode. All LEDs are extinguished in the standby-mode, if the set values are above 0V.
The failure optocoupler transistor becomes conductive.
This status remains active after the cause of the disturbance is eliminated.

The unit can be restarted by placing the sliding switch on the front panel in the standby-mode (> 2sec) and then in the "on" position, or by interrupting the current of the standby/on-optocoupler (>2sec). Both remedies have the same effect (resetting error message).
For standby-operation one or the other remedy is required.

For ”on” operation both conditions have to be met (current through the optocoupler and sliding switch on ”on”).
If the cause of the error has been eliminated a control LED usually lights up and the failure optocoupler transistor is blocked.
If the error continues, the unit is switched to standby-mode again, the failure optocoupler transistor remains conductive. See table.

The following table provides a brief **overview** for troubleshooting:

Problem 1	**None of the front panel LEDs lights up**	**Remedy**
1st possibility	Power supply not connected	Connect power supply
2nd possibility	Sliding switch is on standby or standby/on-optocoupler is without voltage.	Place the sliding switch to on and supply standby/on-optocoupler with voltage
3rd possibility	Sliding switch is on ”on” and failure optocoupler transistor is conductive ---> shut down due to error.	Reset error message on --> standby (2 sec) --> on or brief power interruption on standby/on-optocoupler
4th possibility	Output voltage not available. Error message active again immediately after resetting ---> shut down due to excess temperature.	Check fan function. Improve the inlet and outlet ducts of the power supply.
5th possibility	Error cannot be resetted ---> shut down due to overvoltage protection.	Check the output for foreign voltage. Check sensor switching.
Problem 2	**The output voltage on the load connections is below the specified set value on the interface**	**Remedy**
1st possibility	Sense leads operation required.	Connect sense leads to the load.
2nd possibility	Current or power controllers intervene in the operation when loaded.	If possible, increase set values for current and power.

Troubleshooting

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

Problem 3	No output voltage present	Remedy
1st possibility		Go to problem 1
2nd possibility	If the CC LED lights up, there might be a short circuit or the current set value is 0V.	Place the sliding switch to standby or briefly interrupt the power supply´s optocoupler on the standby/on-optocoupler. Eliminate the output short circuit Check current set value.
3rd possibility	If the CP LED lights up the power set value is 0V.	Check power set value.
4th possibility	CV, CP, CC LEDs light up: Set values are at 0V, or programming connector is unplugged.	Check set value voltages. Check programming connector.
5th possibility	Wire rupture in the interface line, or faulty wiring of the interface.	Unplug interface connector and connect interface termination supplied. Check the unit function by turning the potentiometer on the front panel.

Problem 4	The output voltage does not reach the set value	Remedy
1st possibility		Go to problem 2.
2nd possibility	If the CC LED lights up the unit is operating in current control operation.	If possible increase the current set value until the voltage controller activates.
3rd possibility	If the CP LED lights up the unit is operating in power control operation.	If possible increase the power set value until the voltage controller activates.
4th possibility	Phase failure in the three-phase network or fuse failure in the unit. PFS optocoupler signalises this state by a pulsating signal.	Check mains voltages, after switching off the mains. Check the unit´s fuses.

Description Energy 3000

Mechanic, Environmental, Safety

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

CE
EMC + Safety tested

Mechanics

The primary switched power supplies of the **energy 3000** series are available either as installation units or as 19" versions.
The sturdy mechanical structure is of aluminium.
Extruded profiles developed in-house for cooling brackets and corner profiles form the basis for the finely tuned balance between mechanical sturdiness, protection against electromagnetic interference and optimal heat dissipation. The cooling is attained through temperature controlled fan operation.

Enclosure rating:
- for full rack module
IP 30 acc. to EN 60529/IEC 529
when built-in, at the front panel
- for the installation unit
IP 20 according to
EN 60529/IEC 529

Mechanical maximum stress:
Vibrations:
0.15mm double amplitude
or 2g at 5 - 500Hz
according to DIN 40046
(same values in transport packaging)

Shock:
10g; duration 11ms
according to DIN 40046
in transport packaging
10g, duration 18ms.

Environmental

Operating temperature range:
see data sheet.

Storage temperature:
see data sheet.

Humidity: 95% ,
without condensation.

Safety

RoHS
EU Directive 2011/65/EU

The reduction of hazardous substances in electrical and electronic equipment is an important contribution to the protection of the environment and deserves the strongest possible support from all of us.
All Kniel products/power supplies delivered after 15 January 2006 comply with EU Directive 2011/65/EU except for some customer specific products. Products not compliant with said directive are noted as such in the delivery documents.

WEEE
EU Directive 2012/19/EU

Directive 2012/19/EU particularly applies to short-lived consumer goods for the mass market. Kniel products are generally used as capital goods over periods of many years or even decades. Therefore our products do not belong to the intended target group of the directive. Additionally said directive focusses on complete units or systems and thus does not cover our products. None of our products can be classified into one of the categories mentioned in said directive. Hence, Kniel does not plan to provide statistical information about when our products were placed on the market. We do not offer cost-free return of our products.

Safety

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

Electrical Safety

Kniel primary switched power supplies are designed to cover a broad range of applications. The power supplies are being built according to **EN 60950 / IEC 950** for safety of data processing equipment, including electrical office machines, in order that the conventional regulations applicable to different fields of application are observed.

Important Electrical Safety Features

All output circuits are electrically isolated, both with respect to each other and with respect to the input circuit.
Electrical isolation between primary and secondary circuits by adequate clearances and creepage distances.
Every unit is subject to a high-voltage test to ensure that safe electrical isolation is actually provided.
Test voltages (proof voltages)
for units with output voltages
≥ **90V**:

primary	- secondary	4 250 Vdc
primary	- PE	2 700 Vdc
secondary	- PE	1 250 Vdc

for units with output voltages
> **90V…** ≤ **200V**:

primary	- secondary	4 250 Vdc
primary	- PE	2 700 Vdc
secondary	- PE	1 681 Vdc

for units with output voltages
> **200V…** ≤ **300V**:

primary	- secondary	4 250 Vdc
primary	- PE	2 700 Vdc
secondary	- PE	2 000 Vdc.

Note

On no account do we recommend a repeat test by the customer according to EN 60950/IEC 950 since this could damage semiconductors and insulation and an internal active high voltage limitation will limit the proof voltage. If a further high-voltage test on each unit is mandatory, the test conditions must be coordinated with Kniel. Otherwise, we are unable to accept warranty.

SELV

Kniel power supplies with an output voltage of max. 55Vdc keeps to the requirements of SELV circuits. SELV circuits need a surely electric isolation to the mains.

Definition of the Ambient Conditions According to EN 60950/IEC 950

Pollution Severity II
Only non-conductive pollution occurs. Temporary conductivity as the result of condensation must be anticipated occasionally.

Overvoltage Category II
Equipment of overvoltage category II is intended for use in installations or parts thereof in which lightning overvoltage does not need to be taken into con-sideration. This includes, for instance, domestic electrical appliances. Overvoltages resulting from switching operations must be taken into consideration.

Definition of the Safety Class

Kniel primary switched power supplies are constructed according to safety class I. With this safety class, all exposed parts must be connected to the PE wire with low resistance. Each unit is tested before delivery.

Leakage Current

The maximum permitted leakage current of permanently installed equipment is 3.5mA. Kniel power supplies of this series do not exceed this value between 45 and 66Hz frequency of the mains.

More Tests

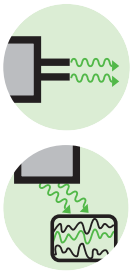
A fire resistance test, an overload test and a test of mechanical load capability are also conducted according to EN 60950/IEC 950.
A test designated "operation not as intended and incorrect operation" is conducted in order to allow us to assess the risks and dangers if the unit is operated not as intended.

EMC + Safety tested

EMC

The switched mode power supplies fully comply with the legal requirements for emitted interference according to EN 55022/55011 as well as the interference immunity according to EN/IEC 61000-6-2.
To fully serve this wide application area the regulations for the domestic and commercial sectors apply for emitted interference, and the regulations for the industrial sector apply for the interference immunity. This means in each case, that a more stringent limit value is valid.

Emitted interference according to EN 55022/55011 (emission)



In primary switched power supplies radiated noise is generated by high-frequency, periodic switching operations. The higher the switching frequencies and the steeper the rising or falling edges of current and voltage are, the higher will be the high-frequency share of the noise spectrum.
The noise spectrum is considered over a bandwidth of 150KHz to 1 000MHz.
Up to 30MHz the interference voltage is measured and evaluated on lines. Either an average measurement*1 or as a quasi-peak measurement*2.
In the higher frequency band between 30MHz and 1 000MHz, the radiated interference fields are recorded at 10m distance.
The permitted limit values are intended to prevent neighboring electronic equipment being affected by interference. Corresponding limit values are stipulated in EN 55022.
Limit curve B must be observed if the primary switched power supplies are used on residential or commercial premises or in public facilities. See figure 5 and figure 6.
The limiting values for industrial applications are defined in EN 55011.

Fig. 5
Limit value class
150KHz to 30MHz

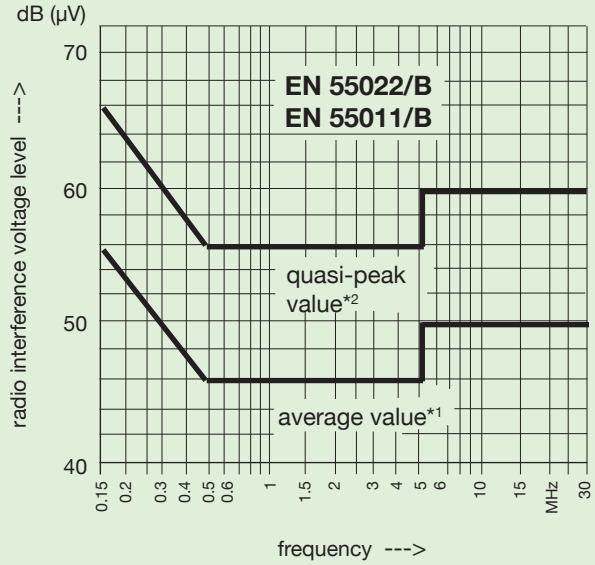
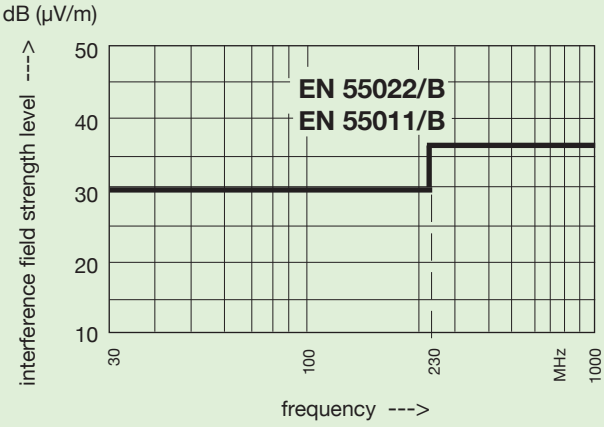


Fig. 6
Limit value class
30MHz to 1 000MHz



*1 = The average value is the arithmetic mean value of a signal.

*2 = In the case of a quasi-peak measurement, the peak value of noise voltage is evaluated in conjunction with the pulse frequency.

Description Energy 3000

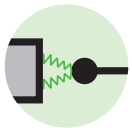
EMC

VE3PUI programmable V/I/P Programming Voltage 0 - 5V

Interference Immunity According to EN/IEC 61000-6-2

The immunity to electromagnetic interference, as occurs in practice as the result of static discharges, switching operations on inductive circuits and capacitors, as the result of lightning strike and as the result of high-frequency irridiation is verified by a series of tests.
The limit values according to EN/IEC 61000-6-2 (industrial application) apply for Kniel primary switched power supplies.

ESD - Immunity to Electrostatic Discharge According to EN/IEC 61000-4-2

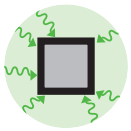


This test verifies the immunity to electrostatic discharge as may occur from the operator's body when touching the equipment. Static discharges as can arise between different objects are also covered with this test.
The required test voltage (proof voltage) is:

8kV - discharge in air
4kV - contact discharge.

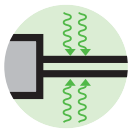
Evaluation criterion B.
Kniel primary switched power supplies meet evaluation criterion A.

Immunity to Electromagnetic Fields According to EN/IEC 61000-4-3



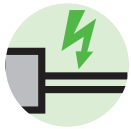
Electromagnetic fields are generated by radio-telephony equipment, radio broadcasting stations, TV stations and other industrial electromagnetic interference sources. The aim of this standard is to ensure immunity of equipment. The test covers the frequency band from 80MHz to 1 000MHz with a field strength of 10V/m.
The measurement is carried out in a booth.
No limit values or maximum permissible deviations are stipulated in the standard.
The output voltage may not deviate more than 2% from the value set during this test.

Fast Electrical Transients Burst Test According to EN/IEC 61000-4-4



Fast transient bursts occur during switching operations, e.g. disconnecting inductive loads and bounce of relay contacts, in all electrical power supply systems.
The burst test is intended to guarantee that the function of electrical equipment is not impaired on a sustained basis as the result of these extremely brief voltage peaks.
The standard demands:
Evaluation criterion B.
Kniel primary switched power supplies meet evaluation criterion A.

Immunity to Surge Voltages According to EN/IEC 61000-4-5



This type of surge voltage occurs in supply systems as the result of switching large inductive circuits or capacitor banks, as the result of short-circuits in the system or as the result of lightning strike.

The standard demands:

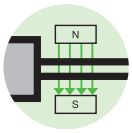
2kV	L1 / N	-->	SL
1kV	L1	-->	N.

Evaluation criterion B is met.

Immunity to Conducted Interference Induced by High-Frequency Fields According to EN/IEC 61000-4-6

In the frequency band 150kHz to 80MHz, the equipment is subject to modulated fields which induce noise voltages of 10V in the supply lead.
No limit values or maximum permissible deviations are stipulated in the standard.
The output voltage may not deviate more than 2% from the value set during this test.

Magnetic Field with Energy Frequency According to EN/IEC 61000-4-8

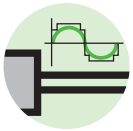


In the frequency range between 50Hz and 60Hz the device is applied with 30A/m. There must be no interference.
Kniel primary switched power supplies meet evaluation criterion A.

Collapse of Voltage and/or Voltage Interruptions According to EN/IEC 61000-4-11

The requirements demanded by EN/IEC 61000-4-11 for collapse of voltage and/or voltage interruptions are fully met.

Limits for Harmonic Current Emissions According to EN/IEC 61000-3-2



The requirements demanded by EN/IEC 61000-3-2 for harmonic current emissions are fully met.
Our power supplies with three-phase input are considered to be professional equipment.

Note

Compliance with the specified standards applies only to the Kniel power supplies.
If the power supply is integrated in an overall system, it is the user's obligation that the complete system meets the applicable standards.
Kniel is unable to assume warranty for this owing to the wide variety of applications.
Please consult Kniel regarding test conditions if the interference immunity tests are to be repeated.

Explanation: evaluation criterion

A : In this test the function may not be influenced in any way.

B : Partial loss of power or function. After completing the test the unit must operate within its specification again.