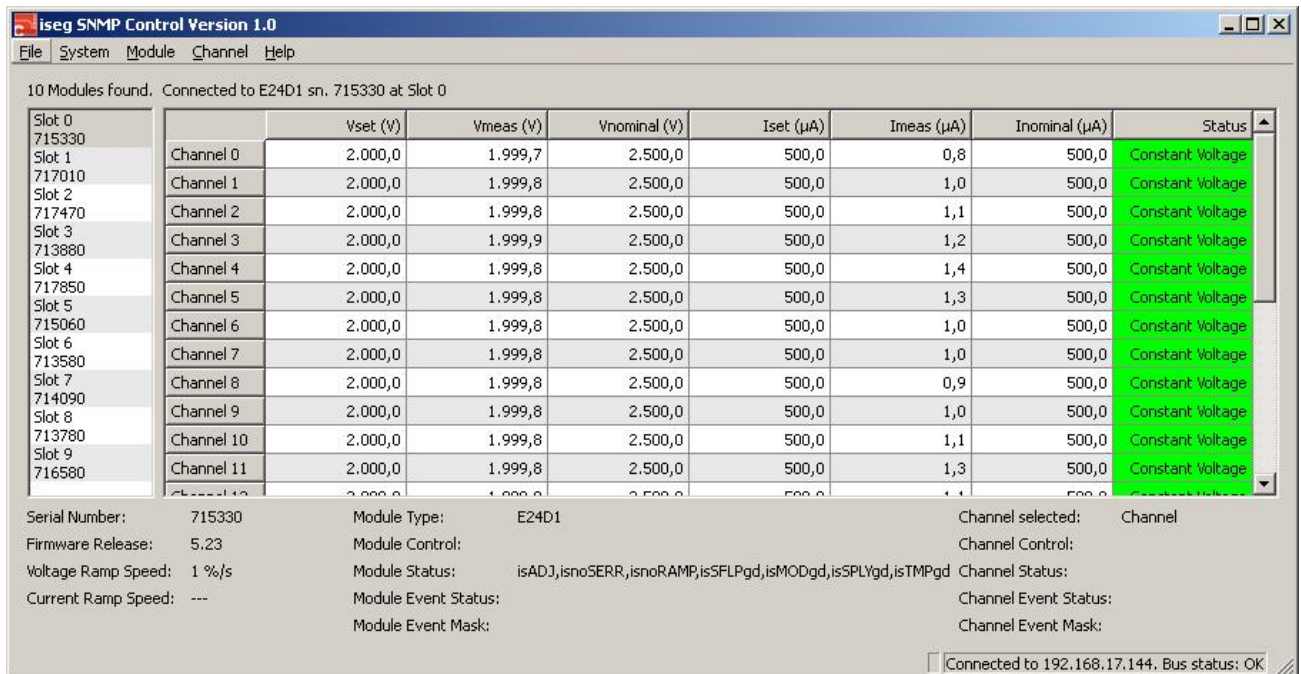


iseq SNMP Control

1. Introduction

iseq SNMP Control is a graphical program to control iseq high voltage and WIENER low voltage devices in a WIENER MPOD crate (10 slots) or MPOD Mini Crate (4 slots) or MPOD Micro Crate (1 slot).



Slot	Channel	Vset (V)	Vmeas (V)	Vnominal (V)	Iset (µA)	Imeas (µA)	Inominal (µA)	Status
Slot 0 715330	Channel 0	2.000,0	1.999,7	2.500,0	500,0	0,8	500,0	Constant Voltage
Slot 1 717010	Channel 1	2.000,0	1.999,8	2.500,0	500,0	1,0	500,0	Constant Voltage
Slot 2 717470	Channel 2	2.000,0	1.999,8	2.500,0	500,0	1,1	500,0	Constant Voltage
Slot 3 713880	Channel 3	2.000,0	1.999,9	2.500,0	500,0	1,2	500,0	Constant Voltage
Slot 4 717850	Channel 4	2.000,0	1.999,8	2.500,0	500,0	1,4	500,0	Constant Voltage
Slot 5 715060	Channel 5	2.000,0	1.999,8	2.500,0	500,0	1,3	500,0	Constant Voltage
Slot 6 713580	Channel 6	2.000,0	1.999,8	2.500,0	500,0	1,0	500,0	Constant Voltage
Slot 7 714090	Channel 7	2.000,0	1.999,8	2.500,0	500,0	1,0	500,0	Constant Voltage
Slot 8 713780	Channel 8	2.000,0	1.999,8	2.500,0	500,0	0,9	500,0	Constant Voltage
Slot 9 716580	Channel 9	2.000,0	1.999,8	2.500,0	500,0	1,0	500,0	Constant Voltage
Slot 10 713780	Channel 10	2.000,0	1.999,8	2.500,0	500,0	1,1	500,0	Constant Voltage
Slot 11 716580	Channel 11	2.000,0	1.999,8	2.500,0	500,0	1,3	500,0	Constant Voltage

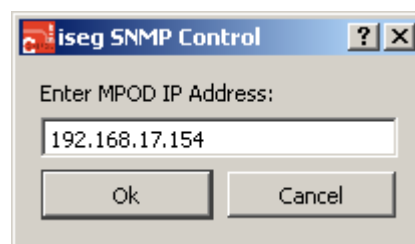
Serial Number: 715330 Module Type: E24D1 Channel selected: Channel
 Firmware Release: 5.23 Module Control: Channel Control:
 Voltage Ramp Speed: 1 %/s Module Status: isADJ,isnoSERR,isnoRAMP,is5FLPgD,isMODgd,isSPLYgd,isTMPgd Channel Status:
 Current Ramp Speed: --- Module Event Status: Channel Event Status:
 Module Event Mask: Channel Event Mask:

Connected to 192.168.17.144. Bus status: OK

The remote control is done using Ethernet wiring and the Simple Network Management Protocol (SNMP). This program uses the net-snmp library as SNMP interface.

1.1 Connect to a MPOD

To connect to a MPOD, use File → Select Controller... The following dialog appears:

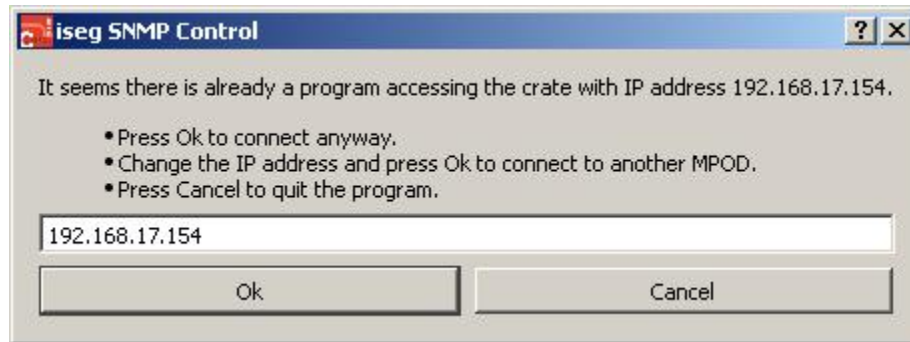


Enter the MPODs IP address and then press Ok. The program connects to the MPOD and reads out all module and channel informations.

If your module list does not contain all modules you expect, or if some channels contain strange Vnominal or Inominal values, try to connect again to the MPOD Controller. After power-on, it takes some time for the MPOD Controller to scan all connected modules. After approximately 15 seconds all modules should be scanned.

1.2 Multiple instances of iseg SNMP Control

If a second instance of iseg SNMP Control is started, the following dialog appears:



This dialog allows the user to:

- Press Ok to connect anyway (In case there is a stale lockfile).
- Change the IP address and press Ok to connect to another MPOD.
- Press Cancel to quit the second instance.

1.3 Program overview

The program main window is divided in three parts:

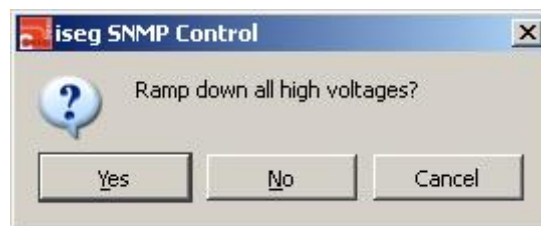
1. At the left side, a list of connected modules is shown
2. At the right side, a channel table for the selected module is shown. The table consists of the following columns:

Vset	The <u>demanded</u> output voltage
Vmeasure	The currently measured output voltage
Vnominal	The maximum output voltage
Iset	The demanded output current
	○ The letter 'T' is shown if the channel is configured for <u>Delayed Trip</u> .
	○ The letter 'K' is shown if the module is in mode <u>Kill Enable</u> .
Imeasure	The currently measured output current.
	○ The letter 'L' is shown if the measured value is from the Low Current Range.
Inominal	The maximum output current
Status	The current <u>channel status</u> (e.g. Off, Ramping, On, Constant Voltage, Constant Current, Emergency Off)

3. At the bottom, specific information for the selected module and channel are shown

1.4 Program exit

The program is closed by selecting the menu File → Quit. The following dialog appears:



Select:

- Yes to ramp down all channels and close the program
- No to keep all channels on and close the program
- Cancel to keep all channels on and to return to the program

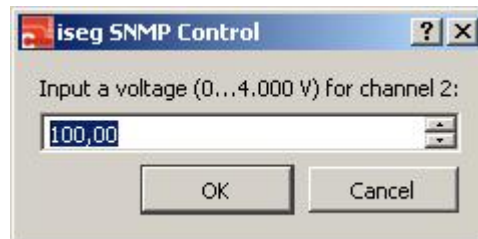
2. First steps

This is a quick start tutorial to get you familiar with iseg Control and iseg High Voltage modules. Typical operations are described here.

2.1 Generating High Voltage

To generate High Voltage, the following steps are necessary:

1. Select the HV channel you want to control with the mouse or the cursor keys.
2. Press V. The Set Voltage input dialog appears:



Input the desired voltage value and press Enter. The value is sent to the module and appears in the Vset column after the module accepted the value.

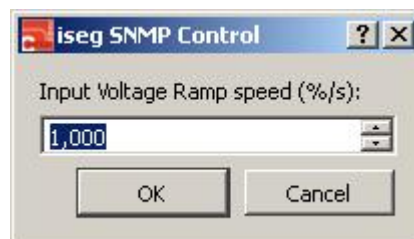
3. Press O to turn the channel on. The channel ramps to the voltage set value with the configured voltage ramp speed. During the ramp, the Status column shows "Ramp".

Note: If the channel was previously turned off by an error, you may need to clear the EventStatus bits before turning on is possible.

2.2 Changing the voltage ramp speed

When turning the High Voltage on or off, or when changing the voltage set value, the High Voltage does not jump to the new value but changes in small steps with a specific ramp speed. This is necessary to avoid high currents on capacitive loads (e. g. for detector protection).

Press R or choose menu Module → Set Voltage Ramp... to change the voltage ramp speed. The ramp speed is entered in percent per second.



Most devices allow 0.001 up to 20 percent. Example: with a ramp speed of 20 percent, it takes five seconds to ramp from zero to the nominal value.

Note: This setting is module-wide and therefore identical for all channels in a module.

Note: The upper limit for the voltage ramp is 1 % in mode Kill Enable or if Delayed Trip is enabled.

2.3 Turning off the High Voltage

Select the HV channel you want to turn off. Press F or choose menu Channel → Set Off. The High Voltage ramps to zero with the configured voltage ramp speed.

Note: due to internal and external capacities connected to the channel, long discharge times may occur before the High Voltage reaches zero.

2.4 Event clearing

Events capture Status changes. They indicate that something happened since the last time this Event was cleared.

Some Events prevent turning on the High Voltage if their corresponding Event Mask bit is set. The easiest way to clear all Events in a module is by pressing F10 or by menu Module → Clear all Events.

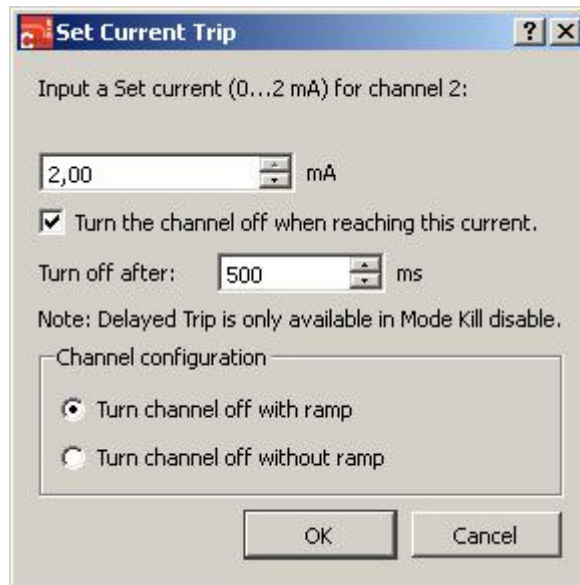
The following Events will block the High Voltage generation:

- Event Voltage Limit
- Event Current Limit
- Event Current Trip
- Event Emergency Off
- Event External Inhibit
- Event Voltage Bounds
- Event Current Bounds
- Event Safety Loop (module wide)
- Event Temperature (module wide)
- Event Supply (module wide)

2.5 Set a Delayed Trip

This dialog allows to set a current value and to select the action that is performed when this current is reached.

Select a channel and press T or use Menu Channel → Set Current Trip... to open this dialog.



If the Checkbox "Turn the channel off when reaching this current" is checked, a delayed trip time can be configured in the range of 8 to 4095 Milliseconds. When the output current is larger then the set value, the channel goes in Current Control mode and acts as constant current source. When the configured trip time is elapsed, the channel can perform one of two special actions:

- Turn channel off with ramp: The channel is turned off with the configured ramp speed
- Shut channel without ramp: The channel is immediately shut down

Note: This setting is done with the help of variable groups and is not available if the groups are used otherwise.

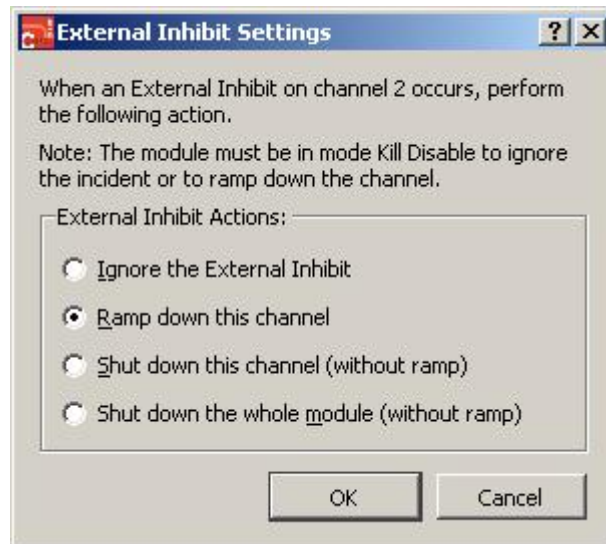
Note: This setting is only available in mode Kill Disable.

Note: The letter 'T' is shown in the Iset column if the channel is configured for Delayed Trip.

2.6 Configuring an External Inhibit action

This dialog allows to set an action that is performed, when an External Inhibit for a channel becomes active.

Select a channel and press N or use Menu Channel → Set External Inhibit Action... to open this dialog.



Four possible actions exist:

- Ignore the External Inhibit: Only the Event "External Inhibit" is set
- Ramp down this channel: The channel is turned off with the configured ramp speed
- Shut down this channel: The channel is shut down without ramp
- Shut down the whole module: All channels were shut down without ramp

Note: This setting is only available in mode Kill Disable.

2.7 Emergency shut down the High Voltage

Select the HV channel you want to turn off. Press Y or choose Channel → Emergency Off. The High Voltage is shut down without ramp.

When a channel is in state Emergency Off, it cannot be turned on. First, leave the state Emergency Off by pressing M or choose Channel → Clear Emergency Off.

Next, you may need to clear the Event Status bit Emergency Off before the High Voltage can be turned on.

Note: due to internal and external capacities connected to the channel, long discharge times may occur before the High Voltage reaches zero after an Emergency Off.

2.8 Instructions for all channels

For faster control, it is possible to perform the same operation on all channels in a module. For example, set all channels to the same voltage set value or turn on all channels. These Operations are located in the Menu Module → Instructions for all Channels.

For easy usage, these operations use the same keyboard shortcuts as the single channel operations in combination with the Control key.

2.9 Direct editing in table

The demanded values for voltage (Vset) and current (Iset) can be entered directly in the table. To achieve this, double click on the Vset or Iset cell of the desired channel, edit the shown value and press Enter to send the value to the module.

With keyboard, navigate to the cell you want to change, press F2, edit the shown value and press Enter to send the value to the module.

2.10 Status Summary

The last column in the channel table is Status. The Status cell can contain the following conditions:

Off	Channel is Off
On	Demanded Set On, but not yet on
On	Channel is On and in stable condition
Ramping	Channel is ramping to to the Set Voltage or to zero
Ramping	Channel is ramping to to the Set Voltage or to zero (neither Constant Voltage nor Constant Current is satisfied)
Constant Voltage	Channel is in Constant Voltage mode
Constant Current	Channel is in Constant Current mode
Emergency	Channel is in state Emergency Off
Inhibit	Channel is shut down via External Inhibit
Voltage Limit	Channel is in Voltage Limit
Current Limit	Channel is in Current Limit
Current Trip	Channel is turned off because of <u>Current Trip</u>
Voltage Bounds	Channel is in Voltage Bounds
Current Bounds	Channel is in Current Bounds

2.11 Load Module

Load modules have both internal measurement and the possibility to select one channel for external measurement.

The operating modes are switched with the menu items in menu Channel → Load Module or with the Channel context menu when a load module is selected.

2.12 Internal and external Measurement

The internal measurement measures voltage and current of all channels sequentially.

Furthermore, the selected channel of a load module can be set in one of the following operating modes:

- External Measurement On
- Ripple Measurement On
- External And Ripple Measurement On
- Both Measurements Off (internal measurement is activated)

2.13 Auto-switch Measurement

The function "Auto-switch Measurement" automatically sets the selected channel to External and Ripple measurement. This allows easy switching through all channels with the Up and Down keys.

This function is only located in the menu Channel → Load Module.

Note: Selecting this function again switches off the automatic measurement switching.

2.14 Do Multiplex

To activate the internal Measurement for all channels, the command "Do Multiplex" can be used. In this case, the user doesn't have to know which channel is set to External or Ripple Measurement.

2.15 Switchable Resistors

Some Load modules have two switchable resistors. One or both of these resistors can be activated and deactivated for all channels for all channels at once.

Note: Switching resistors is not available over SNMP at the Moment.

3. Main menu structure

File	
Select Controller...	Open the <u>dialog</u> to connect to an other MPOD crate
Password...	Open the <u>password</u> dialog to activate further functions
Statistic...	Open the statistic dialog to save measurement data
Load Profile in Device...	(VME only) Loads a stored profile into the selected module
Save Profile to File...	(VME only) Stores the selected modules settings in a profile file
Quit	<u>Closes</u> the program

System	
Module Overview...	Open the overview dialog
Crates...	Open the dialog to control crate functions
Set Crate Address...	Programs a new IP address into the MPOD
Set All Modules On	Set all channels in all connected modules on
Set All Modules Off	Set all channels in all connected modules on
Set All Modules Voltage...	Open the dialog to set a new demanded voltage for all channels in all connected modules
Set All Modules Current...	Open the dialog to set a new demanded current for all channels in all connected modules
Set All Modules Current Trip...	Open the <u>dialog</u> to set a current trip for all channels in all modules
Set All Modules External Inhibit Action...	Open the <u>dialog</u> to configure an external inhibit action for all channels in all modules
Set All Modules Voltage Ramp...	Open the dialog to set a new voltage ramp speed for all connected modules
Set All Modules Current Ramp...	Open the dialog to set a new current ramp speed for all connected modules
Clear All Modules Events	Resets all captured events in all connected modules
Set All Modules Emergency Off	Set all channels in all connected modules to state emergency off
Clear All Modules Emergency Off	Reset all channels in all connected modules from state emergency off
Set All Modules Fine Adjustment On	Activate the fine adjustment function in all connected modules
Set All Modules Fine Adjustment Off	Deactivate the fine adjustment function in all connected modules

Module	
Select Module...	Open the dialog to select a module
Previous Module	Select the previous module in the module list
Next Module	Select the next module in the module list
Set Voltage Ramp...	Open the <u>dialog</u> to set a new module voltage ramp speed
Set Current Ramp...	Open the dialog to set a new module current ramp speed
Clear All Events	Reset all captured channel and module events
Supplies and Temperature...	Open the dialog with information about module supplies and temperature
Status / Control...	Open the dialog <u>Module Status / Control</u> with detailed module status information
Instructions for all Channels	Submenu to control all channels at once
Load Module	Submenu to control a Load Module
Set Fine Adjustment On	Activate the fine adjustment function
Set Fine Adjustment Off	Deactivate the fine adjustment function
Settings...	Open the dialog <u>Settings</u>

Channel	
----------------	--

Select Channel...	Open the dialog to select a channel
Set Voltage...	Open the dialog to set a new demanded voltage for the selected channel
Set Current...	Open the dialog to set a new demanded current for the selected channel
Set Current Trip...	Open the <u>dialog</u> to set a current trip
Set External Inhibit Action...	Open the <u>dialog</u> to configure an external inhibit action
Set Channel On	Set the selected channel on
Set Channel Off	Set the selected channel off
Set Emergency Off	Set the selected channel to state emergency off
Clear Emergency Off	Reset the selected channel from state emergency off
Clear Events	Reset all captured events for the selected channel
Status / Control	Open the dialog <u>Channel Status / Control</u> with detailed channel status information
Load Module	Submenu to control a Load Module

Help	
Index	Open the online help in the operating systems's default web browser
About...	Open the dialog with program release and licence information
About Qt...	Open the dialog with information about the used <u>Qt</u> version

4. Keyboard shortcuts

4.1 Commands for a single Channel

These commands affect the currently selected channel.

Key	Function
C	Select a channel
Up	Select previous channel in table
Down	Select next channel in table
V	Set a new voltage for the selected channel
I	Set a new current for the selected channel
T	Set a new trip current and trip time for the selected channel
O	Set the selected channel on
F	Set the selected channel off
Y	Set the selected channel to state "Emergency Off"
M	Reset the selected channel from state "Emergency Off"
S	Show dialogue "Channel Status / Control"
B	Set new bounds for the selected channel
F9	Clear Events for the selected channel
F2	Start direct value editing in cell Vset or Iset

4.2 Commands for all Channels

These commands affect all channels in the currently selected module.

Key	Function
Ctrl+V	Set new voltage for all channels
Ctrl+I	Set new current for all channels
Ctrl+T	Set new trip current and trip time for all channels
Ctrl+O	Set all channels on
Ctrl+F	Set all channels off
Ctrl+E	Set all channels to mode "Kill Enable"
Ctrl+D	Set all channels to mode "Kill Disable"
Ctrl+Y	Set all channels to state "Emergency Off"
Ctrl+M	Reset all channels from state "Emergency Off"

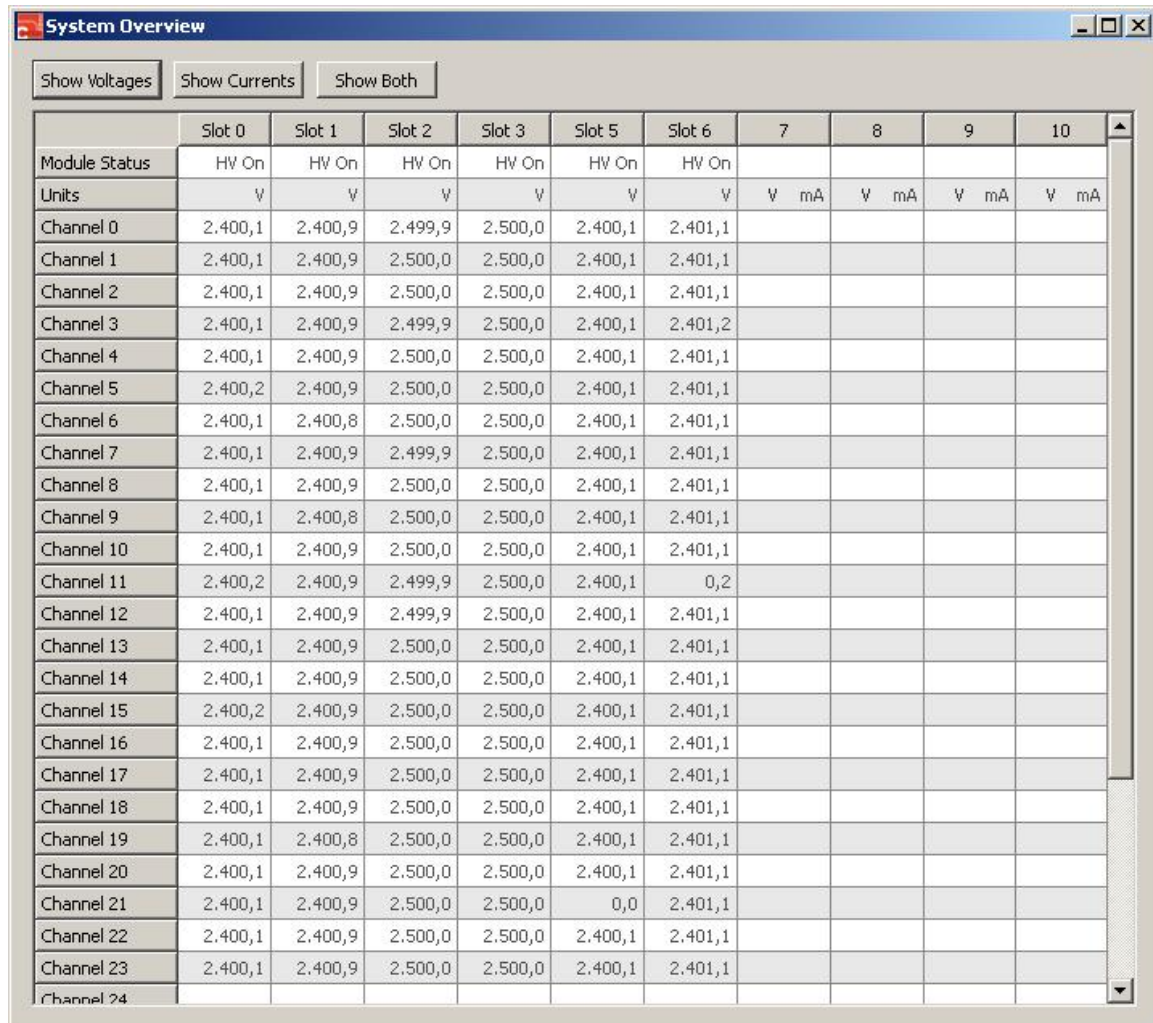
4.3 Commands for the Module

These commands provide module-wide operations for the selected module.

Key	Function
Page Up	Select previous module in module list
Page Down	Select next module in module list
R	Set new Voltage Ramp Speed
Shift+R	Set new Current Ramp Speed
A	Set new ADC sample rate
D	Set new Digital Filter (Averaging)
Ctrl+S	Show dialogue "Module Status / Control"
Ctrl+G	Show dialogue "Variable Groups"
F12	Show dialogue "Special Mode" for Firmware update
F11	Show dialogue "Factory Settings"
F10	<u>C</u> lear all module Events
F8	Program a new Module VME Base Address
F7	Show dialogue "Interlock Out"

5. Dialog Overview

The Overview dialog shows a system overview.



	Slot 0	Slot 1	Slot 2	Slot 3	Slot 5	Slot 6	7	8	9	10
Module Status	HV On	HV On	HV On	HV On	HV On	HV On				
Units	V	V	V	V	V	V	V mA	V mA	V mA	V mA
Channel 0	2.400,1	2.400,9	2.499,9	2.500,0	2.400,1	2.401,1				
Channel 1	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 2	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 3	2.400,1	2.400,9	2.499,9	2.500,0	2.400,1	2.401,2				
Channel 4	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 5	2.400,2	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 6	2.400,1	2.400,8	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 7	2.400,1	2.400,9	2.499,9	2.500,0	2.400,1	2.401,1				
Channel 8	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 9	2.400,1	2.400,8	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 10	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 11	2.400,2	2.400,9	2.499,9	2.500,0	2.400,1	0,2				
Channel 12	2.400,1	2.400,9	2.499,9	2.500,0	2.400,1	2.401,1				
Channel 13	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 14	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 15	2.400,2	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 16	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 17	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 18	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 19	2.400,1	2.400,8	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 20	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 21	2.400,1	2.400,9	2.500,0	2.500,0	0,0	2.401,1				
Channel 22	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 23	2.400,1	2.400,9	2.500,0	2.500,0	2.400,1	2.401,1				
Channel 24										

In one table, all modules are displayed as columns and all channels are displayed as rows.

The table can be configured with buttons to show:

- Measured voltage for each channel (Show Voltages)
- Measured current for each channel (Show Currents)
- Measured voltage and measured current for each channel (Show Both)

The first row shows a module summary status:

- "HV On" if at least one channel is on
- "Ramping" if at least one channel is ramping
- "HV Off" if all channels are off
- "Error" if at least one channel has a masked event

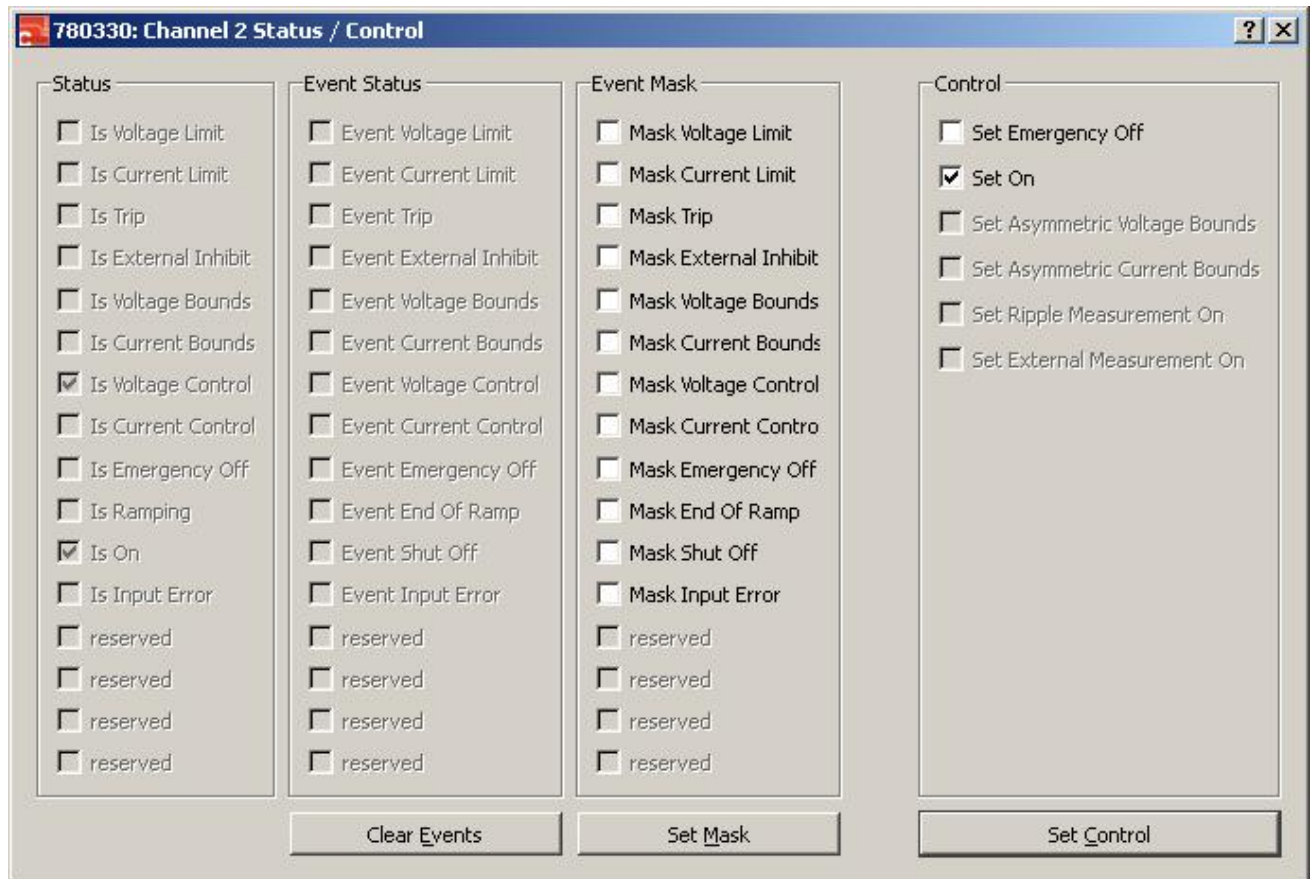
The second row shows the configured voltage and current units for the module.

5.1 Channel Status / Control dialog

The dialog Channel Status / Control shows all relevant Status, EventStatus and Control items for the selected channel.

The dialog Channel Status / Control can be accessed the following ways:

- Select a channel in the table, then choose menu Channel → Status / Control
- Select a channel in the table, then press S
- Select a channel in the table, then click right and choose Status / Control



Status

In the first column, the Status bits are displayed. These bits represent the actual channel status. These bits are updated whenever the status changes.

Bit	Meaning
Voltage Limit	The output voltage is currently higher than the adjusted limit
Current Limit	The output current is currently higher than the adjusted limit
Trip	The measured output current exceeded the adjusted current trip
External Inhibit	An external Inhibit is active
Voltage Bounds	The channel is currently out of the configured voltage bounds
Current Bounds	The channel is currently out of the configured current bounds
Voltage Regulation	The channel is currently in mode voltage regulation ($V_{meas} \approx V_{set}$, $I_{meas} < I_{set}$)
Current Regulation	The channel is currently in mode current regulation ($V_{meas} < V_{set}$, $I_{meas} \approx I_{set}$)

Emergency Off	The channel is currently in state Emergency Off and cannot be turned on. To leave this state, choose menu Channel → Clear Emergency Off
Ramping	The channel is currently ramping to the configured Vset or to Zero
Input Error	The last command caused an input error (e. g. trying to set Vset higher than Vnominal etc.)

EventStatus

In the second column, the EventStatus bits are displayed. These bits represent the captured status. Whenever a Status bit changes to one, the corresponding EventStatus bit is also set. However, the EventStatus bits are not cleared automatically, they must be cleared by the user. This is possible with the Button "Clear Events".

EventMask

In the third column, the EventMask bits are displayed. The EventMask bits serve two purposes:

1. They build a hierarchical error reporting chain
2. They prevent turning on the high voltage after an Error

To change the EventMask, select the desired Mask bits and press the Button "Set Mask".

Nominal values

The possibility to change the nominal values is currently not available.

Control

The Channel Control is currently not available.

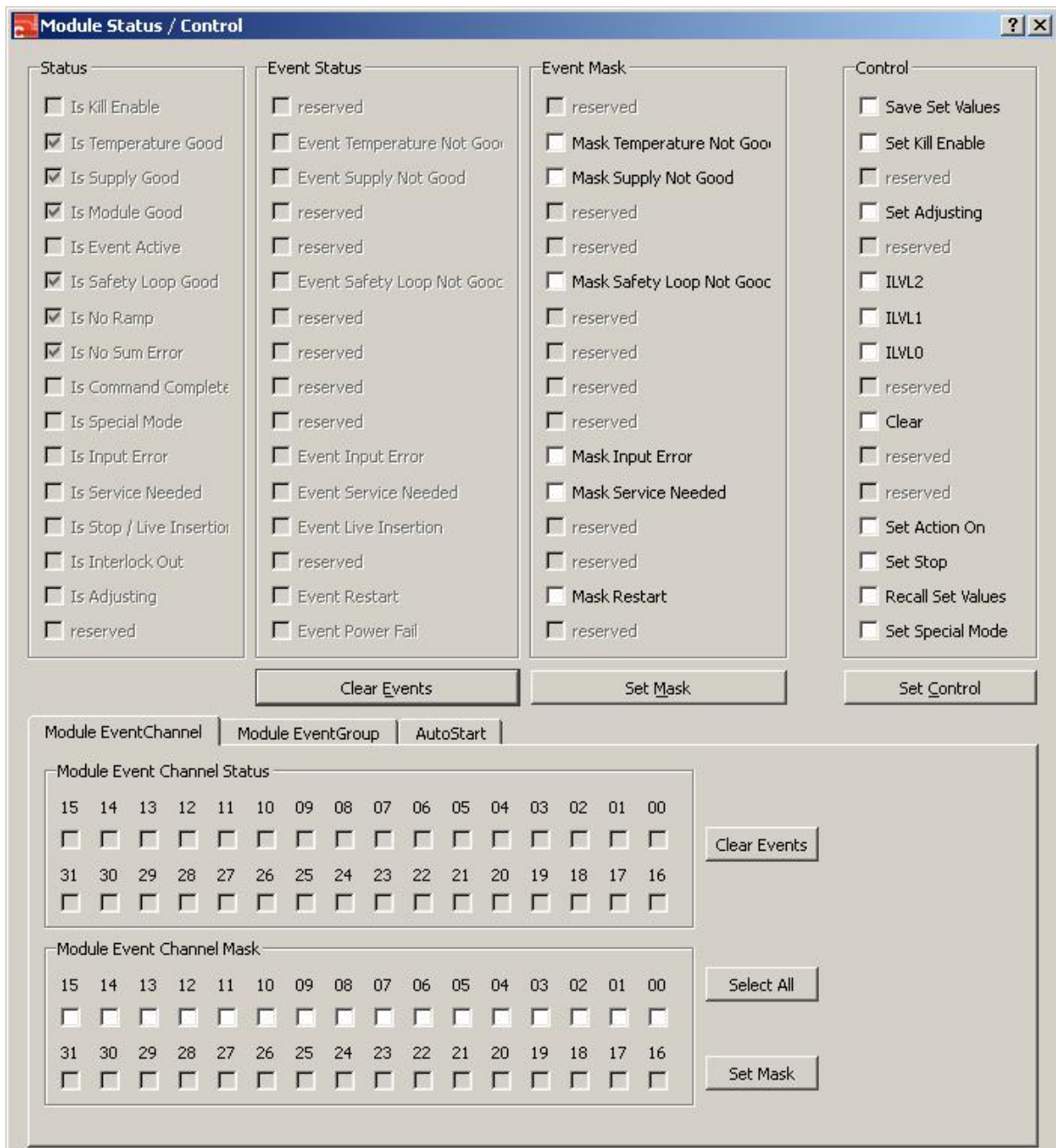
5.2 Module Status / Control dialog

The dialog Module Status / Control shows all relevant Status, EventStatus and Control items for the selected module.

A module is the combination of one or multiple high voltage channels in a common housing.

The dialog Module Status / Control can be accessed the following ways:

- Select a module in the module list, then choose menu Module → Status / Control
- Select a module in the module list, then press Ctrl+S
- Select a channel in the table, then click right and choose Status / Control



Status

In the first column, the Status bits are displayed. These bits represent the actual module-wide status. These bits are updated whenever the status changes.

Bit	Meaning
Is Kill Enable	All Channels are in mode <u>Kill Enable</u>
Is Temperature Good	The module temperature is below 55 °C
Is Supply Good	All supplies are in the allowed range
Is Module Good	
Is Event Active	
Is Safety Loop Good	The Safety Loop is closed
Is No Ramp	No channel is ramping
Is No Sum Error	
Is Command Complete	
Is Special Mode	
Is Input Error	
Is Service Needed	A hardware failure occurred
Is Stop	
Is Interlock Out	
Is Adjusting	All channels are in fine-adjusting state to compensate temperature drifts

Event Status

In the second column, the module-wide EventvStatus bits are displayed. These bits represent the captured status. Whenever a Status bit changes to one, the corresponding Event Status bit is also set. In opposite to the Status bits, the EventStatus bits are not cleared automatically, but must be cleared by the user.

Clearing the module EventStatus is possible with the Button "Clear Events".

Bit	Meaning
Event Temperature Not Good	The maximum temperature was exceeded
Event Supply Not Good	At least one supply was out of range
Event Safety Loop Not Good	The Safety Loop was open
Event Input Error	An input error occurred
Event Service	A hardware error was present
Event Restart	

Event Mask

In the third column, the Event Mask bits are displayed. The Event Mask bits serve two purposes:

1. Build a hierarchical error reporting chain
2. Prevent turning on the high voltage after an error

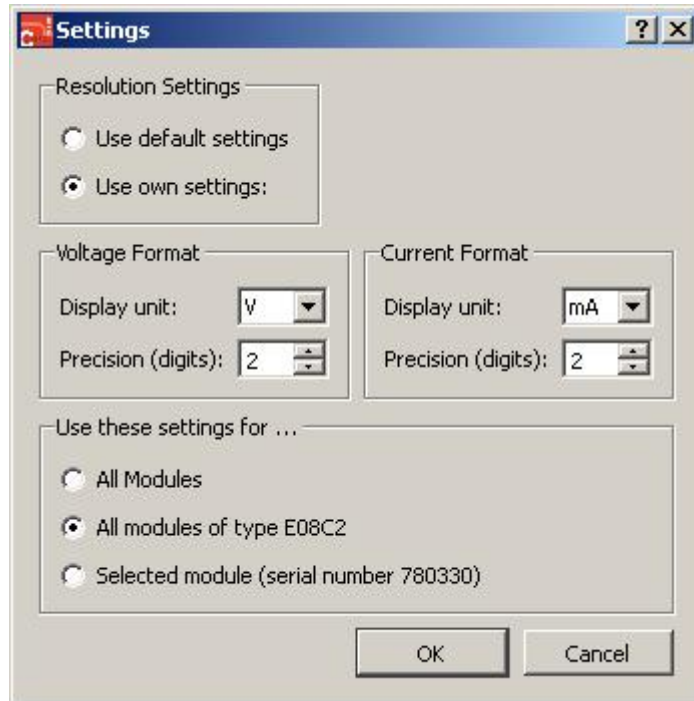
To change the Event Mask, select the desired Mask bits and press the Button "Set Mask".

Bit	Meaning
Mask Temperature Not Good	
Mask Supply Not Good	
Mask Safety Loop Not Good	
Mask Input Error	
Mask Service	
Mask Restart	

Control

The Module Control is currently not available.

6. Dialog Settings



The voltage and current resolution and unit can be configured with the Dialog Settings. It is possible to:

- Select the voltage unit (V, kV)
- Set the voltage precision (0...9 digits)
- Select the current unit (nA, μ A, mA, A)
- Set the current precision (0...9 digits)

These setting can be done for:

- All modules
- A module type (specified via the firmware name)
- A specific module (specified via the serial number)

7. Passwords

Some functions are password protected to avoid unwanted misconfiguration.

The passwords are entered in the File → Password dialog.

Password	Enable the Functions
hex2flash	Special Mode / Firmware Update (VME only)
config	Set Crate Fan Speed
	Program new Crate Address
guru	Set Fine Adjustment On/Off

8. Glossar

Bounds

The channel allows to set a bound around the Vset or Iset values. If the Vmeasure or Imeasure value leaves this range, an Event Voltage Bounds or Event Current Bounds is set. $(Vset - Vbound) \leq Vmeasure \leq (Vset + Vbound)$ $(Iset - Ibound) \leq Imeasure \leq (Iset + Ibound)$

Constant Current (CC)

The channel is working as constant current source: $Imeasure \approx Iset$, $Vmeasure < Vset$.

Constant Voltage (CV)

The channel is working as constant voltage source: $Vmeasure \approx Vset$, $Imeasure < Iset$.

Delayed Trip

A *Current Trip* is an overcurrent that leads to a shut down of the High Voltage without ramp. A Current Trips happens:

- For modules without Constant Current regulation (Distributor HV modules)
- For all modules in mode Kill Enable

A *Delayed Trip* can turn off the High Voltage with or without ramp after a configurable trip timeout. Delayed Trip is only possible for modules with Constant Current regulation.

The Delayed Trip is configured with the Set Current Trip dialog.

Note: The Voltage Ramp Speed is limited to 1 % if Delayed Trip is enabled.

Note: Devices with two current measurement ranges permanently switch to the high current range when Delayed Trip is enabled.

Kill Enable

The mode Kill Enable provides a higher safety.

The following Events shut down the High Voltage without ramp in mode Kill Enable:

- Voltage Limit
- Current Limit
- Current Trip
- Constant Current
- Voltage Bounds
- Current Bounds
- External Inhibit

Note: Devices with two current measurement ranges permanently switch to the high current range in mode Kill Enable.

Note: The Voltage Ramp Speed is limited to 1 % in mode Kill Enable.

Note: The Delayed Trip function is only available in mode Kill Disable.