Chapter II

The isegHVOPCServer for iseg Multi-Channel HV systems

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iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

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iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

OLE for Process Control (OPC) for the iseg Multi-Channel HV systems

The isegHVOPCServer as a part of OLE process control is the link between the OPC client, the iseg Multi-Channel HV modules and / or the iseg system crates.

1 Introduction

The **iseg** Multi-Channel HV system is made of several devices of hardware and software components. The hardware devices are as follows:

- Multi-Channel HV power supply modules
- System crates carrying the HV modules

Each module and each crate offers a microprocessor-based intelligence. The interface which controls and monitors the hardware is the CAN bus. It is following the CAN 2.0B (passive) specification. The data points for the accesses to the module and the crate properties comes together in one executable file and can work on one CAN bus or on different CAN buses in conformity with the configuration files.
The system software interface is made by an OPC server, which follows the rules defined by the OPC Foundation (DA 3.0, 2.0 and 1.0 are supported). Therefore the users of the system must not know the internal protocols in detail.
In order to understand the OPC interface (server namespace), the relevant details of the modules and the crates are described as follows:

2 Modules

Each modules offers up to 32 channels, made of one or two internal cards (PCB). Each internal card represents one CAN node (the most of the modules have 16 channels per card, some modules comes also with another number of channels per card – see instruction "Placed hardware channels" of the EHQ Multi-Channel CAN operators manual). Each channel of the module offers individual properties (see below).
In addition there are properties as groups that summarize a property for all channels and which are controlled by one CAN node.

Properties of one channel:

- set voltage write / read
- current trip write / read
- actual current read
- actual voltage read
- status read

Properties of a channel group (some examples):

- sum error read
- ramp speed read / write
- set voltage for all channels write
- emergency cut-off write

3 Crates

Properties of a crate (some examples):

- actual voltage of single lines read
- temperature read
- Power ON / OFF read / write
- Status read / write
- StatusACLinePower read

The most important information of the crate is the status of the power supplies.

4 Software

4.1 General information

The ***isegCANHVControl.exe*** control software performs all basic monitor and control tasks for modules and crates. It provides a HMI (human machine interface) for all properties of the modules and crates using the proprietary driver of the CAN interface (PEAK). It can be used in order to configure the modules and crates before the work with the ***isegHVOPCServer***. Such configurations are the flash update, changing the bit rate and identifiers for crates, the offset calibration of the module temperature and the permanent saving of setting values inside of the modules.
An alternative and more general control software is based on the standardized OPC interface. With means of the OPC tools is it possible to establish a sever client system in order to access the iseg Multi-Channel HV system, too. The properties of the Multi-Channel HV hardware can be accessed via the item data points.

5 OPC Server part for Multi-Channel HV devices

The OPC server has been developed using the following tools:

- Softing OPC Toolkit, Ver. 4.10, DA 3.0, AE1.01
- Microsoft's Visual C++, Ver. 6.01
- PEAK System's CAN device driver

The OPC server for Multi-Channel HV system is divided into 'Data Access' part and an 'Alarms and Events' part.

5.1 Configuration

First the OPC server has to be configured. It must get all information about the kind of **iseg** HV hardware connected to the CAN bus. This information is stored in the configuration file ***isegHVOPCServer.ini***. The tool ***isegHVOPCcfg.exe*** is used to create this configuration file. It performs a scan on the CAN bus and collects information from the connected CAN nodes (modules and crates). Also it supports the graphical access to the initialising file ***isegHVOPCServer.ini***.
For further details see the configuration manual ***isegHVOPCSetup.pdf***.

5.2 Data Access Server and Alarm and Events Server

5.2.1 Data Access Server

The OPC DA server is made to work with more than one crate. Therefore each item has to be addressed in a geographical way to build a fully qualified item ID that means:

STATUS.COMPONENT	iseg OPC server components (software releases and status of CAN bus)
CANBUS.NODE.CHANNEL.ITEMNAME	data point for channel depending properties
CANBUS.NODE.ITEMNAME	data point for module depending properties

By the use of a special namespace text file – ***isegHVOPCServer.nsp*** – can build user defined fully qualified item IDs. The description is placed in the file ***isegHVOPCUserNameSpace.pdf***. The program ***isegHVOPCUserNameSpace.exe*** is able to make a scan over the namespace and save the information prepared to read by the ***isegHVOPCServer*** from the namespace file.

The properties of Multi-Channel HV system in the OPC server are defined as items. In the simplest case, such an item is directly coupled to a read or write via CAN bus. The ‘set voltage’ is one example.
Some OPC items have to be built up from data read results via CAN. The ‘status current limit’ is one example, which is read as an unsigned integer (2 bytes). Each bit of these 2 bytes represents the status of the current limit of one channel. This bit is interpreted as Boolean. All channels result in an array with 16 elements of Boolean, the ‘StatHwILimitBoolArray’.

There is a feature of ranking these many requests because a client can send many of them. First priority is assigned to emergency off ‘Emcy’, second priority to the command set voltage ‘VSet’. All other requests are under normal (lowest) priority.
A background loop process can be used to update the cache of the changeable channel items continuously. This process reads all measurement data and channel status data from the HV modules and fills the cache of the OPC server namespace. To implement a background loop process the “ReadSync” entry in the OPC initialising file “EHQ3216Srv.ini” have to be a different value from zero. The advantages of this mechanism is a very fast update of the really interesting module properties (Vmeas, Imeas and Stat item) because the group update of this items of an OPC client will cause no device reads if the time stamps of the items are as newer as the last update of the group.

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

5.2.1.1 Item's properties

The items own a sum of the same and a sum of specific item properties.

Each item has as standard properties:
- Item Canonical Data Type
- Item Value
- Item Quality
- Item Time Stamp
- Item Access Rights
- Server Scan Rate
- Item Description

Specific item properties:
- Item EU Type
- Item EU
- Item High EU (the maximum value that the device will accept and/or return)
- Item Low EU (the minimum value that the device will accept and/or return)
- Application Description

5.2.1.2 Items of the status from the server components

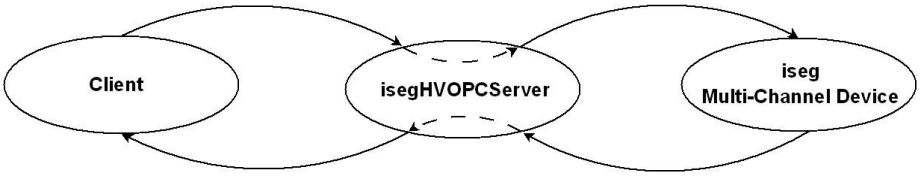
fully qualified identifier	device class	description	access	variant type
Status.release_isegHVOPCServer	all	isegHVOPCServer.EXE	readable	VT_BSTR
Status.HeartBeat	all	heart beat of the server	readable	VT_UI1
Status.release_isegCAN	all	iseg[p/s]can.DLL	readable	VT_BSTR
Status.CAN	all	status of CAN bus	readable	VT_BSTR
Status.Force	all	0=mode1 1=mode2	readable	VT_BOOL
Status.Refresh	all	mode1=0	Readable	VT_UI1

Status.CAN Actual status of the CAN line
Possible values are "OK"
"BUSHEAVY" bus errors e.g. when there is a mix of different bit rates
"BUSOFF" bus error e.g. a short on the bus
"OVERRUN" overflow of the buffer of the CAN driver
In order to select another CAN line for evaluation or to make a reset of the interface hardware of the corresponding CAN line, the number of the real hardware line has to be written to this item (not the number of the user namespace file).

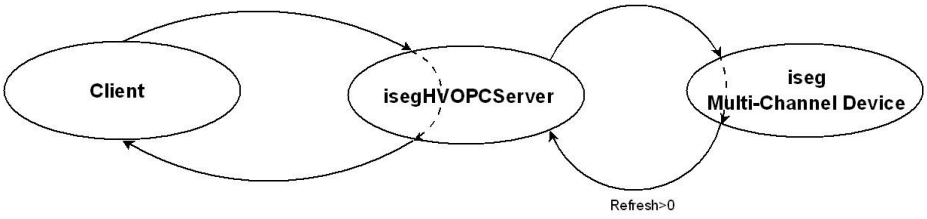
A parallelization of the send and receive thread can be made with the items Force and Refresh to increase:
the update rate of the item cache.
the CAN busload without a noticeable increasing of the system load.

Status.Force

Force=false Mode1
An access to the item cache via an OPC client will be made with a request to the device hardware through the event handler of the item tag connected with a delay until the answer from the device or the time out.



Force=true Mode2 (for Multi-Channel devices only)
An access to the item cache via an OPC client will be made without a request to the device hardware. The update of the item cache can be adjusted with the item Refresh.



iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
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Status.Refresh

The Items listed in Appendix A will refreshed as fast as possible in background.

Useful values are: Refresh=0 - no update of the item cache in background
Refresh>0 up to 32 - update of the item cache in background

A higher value of the item “Refresh” means that more data will request in background with that a higher update rate of the OPC groups is possible, but which increase also the CAN bus load.

A possible handling is:

The client reads all stable items such as can*x*.m*tyy*.ch*zz*.NominalV after the OPC server has been started. In a next step the item “Force” will be set on true value and the group update rate for instance of the items to measurement data points will decrease. The background refresh can be started now with set the “Refresh” item to a value unequal to zero.

5.2.1.3 Items of Data Access to the channel properties

Syntax:	*t* Є [a|p]	module type (active or passive)
	x Є [0..15]	number of the CAN bus
	yy Є [0..63]	number of the CAN node
	zz Є [0..15]	number of the channel

fully qualified identifier	device class	description	access	variant type
can*x*.m*tyy*.chzz.VSet	all	set voltage	write-/ readable	VT_R4
can*x*.m*tyy*.chzz.VMeas	all	actual voltage	readable	VT_R4
can*x*.m*tyy*.chzz.NominalV	all	nominal voltage	readable	VT_R4
can*x*.m*tyy*.chzz.ISet	(all)	set current / set current trip	write-/ readable	VT_R4
can*x*.m*tyy*.chzz.ITrip	all	(set current) / set current trip	write-/ readable	VT_R4
can*x*.m*tyy*.chzz.IMeas	all	actual current	readable	VT_R4
can*x*.m*tyy*.chzz.NominalI	all	nominal current	readable	VT_R4
can*x*.m*tyy*.chzz.Stat	all	status channel in the kind of EHQ	readable	VT_UI2
can*x*.m*tyy*.chzz.On	all	set on = -1, set off = 0	writeable	VT_BOOL
can*x*.m*tyy*.chzz.Emergency	all	set emergency = -1, reset emergency = 0	writeable	VT_BOOL
can*x*.m*tyy*.chzz.doClear	all	reset the errors (EHQ), events (EHS) of the channels	writeable	VT_BOOL
can*x*.m*tyy*.chzz.Status	all (< 20 without any function)	status channel (OPC quality is bad, when it is not an EHS module in EHS mode	readable	VT_UI2
can*x*.m*tyy*.chzz.EventStatus	>20 / (all)	channel event status	write-/ readable	VT_UI2
can*x*.m*tyy*.chzz.EventMask	>20 / (all)	channel event mask	write-/ readable	VT_UI2

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5.2.1.4 Items of Data Access to the module properties

fully qualified identifier	device class	description	access	type
canx.m*tyy*.GeneralStat	all	general status	readable	VT_UI1
canx.m*tyy*.GeneralSafetyLoop	all	safety loop is closed	write-/ readable	VT_BOOL
canx.m*tyy*.GeneralHwVLimitLow	0 / (all)	hardware voltage limit is to low	write-/ readable	VT_BOOL
canx.m*tyy*.Status	>20 / (all)	module status (EHS)	readable	VT_UI2
canx.m*tyy*.EventStatus	>20 / (all)	module event status	write-/ readable	VT_UI2
canx.m*tyy*.EventMask	>20 / (all)	module event mask	write-/ readable	VT_UI2
canx.m*tyy*.EventChannelStatus	>20 / (all)	event channel status	write-/ readable	VT_UI2
canx.m*tyy*.EventChannelMask	>20 / (all)	event channel mask	write-/ readable	VT_UI2
canx.m*tyy*.setAdjust	all	Adjust of the HV on = -1 Adjust of the HV off = 0	writeable	VT_BOOL
canx.m*tyy*.setKillEnable	all	hardware kill enable = -1 hardware kill disable = 0	writeable	VT_BOOL
canx.m*tyy*.doClear	all	Clear all events / errors of the whole HV module	writeable	VT_BOOL
canx.m*tyy*.GroupNumber	>20 / (all)	Index of the variable groups 0 to 31	write-/ readable	VT_UI1
canx.m*tyy*.GroupVariable	>20 / (all)	extended and flexible range of group functions	write-/ readable	VT_UI4
canx.m*tyy*.StatHardwareVLimit	all	status voltage limit – corresponding channel voltage limit = 1	write-/ readable	VT_UI2
canx.m*tyy*.StatHardwareILimit	all	status current limit – corresponding channel current limit = 1	write-/ readable	VT_UI2
canx.m*tyy*.StatINHIBIT	7 / (all)	status INHIBIT – corresponding INHIBIT = 1	write-/ readable	VT_UI2
canx.m*tyy*.StatITrip	all	status current trip – corresponding channel current trip = 1	write-/ readable	VT_UI2
canx.m*tyy*.StatRegulationErr	0, 1, 2 / (all)	status regulation error – corresponding channel error = 1	write-/ readable	VT_UI2
canx.m*tyy*.On	all	corresponding channel set on = 1 or set off = 0	write-/ readable	VT_UI2
canx.m*tyy*.VSetAllChannels	all	set voltage of all channels	write-/ readable	VT_R4
canx.m*tyy*.ISetAllChannels	all	set current of all channels	write-/ readable	VT_R4
canx.m*tyy*.ITripAllChannels	0-5, 8 / (all)	set current trip of all channels	write-/ readable	VT_R4
canx.m*tyy*.RampSpeed	all	speed of the voltage ramp in percent of the nominal voltage of the channel per second	write-/ readable	VT_R4
canx.m*tyy*.IRampSpeed	all	speed of the current ramp in percent of the nominal current of the channel per second (OPTION)	write-/ readable	VT_R4
canx.m*tyy*.Emcy	all	emergency - corresponding channel set emergency = 1 reset emergency = 0	write-/ readable	VT_UI2
canx.m*tyy*.ADCFilterFrequency	all	ADC filter frequency	readable	VT_UI2
canx.mtyy.DeviceID	all	device identifier	readable	VT_BSTR
canx.mtyy.SoftwareID	all	software release	readable	VT_BSTR
canx.mtyy.BitRate	all	bit rate	readable	VT_UI2
canx.mtyy.Option	>20 / (all)	options	readable	VT_BSTR
canx.mtyy.OptionSingleSpec	>20 / (all)	option single specification	write-/ readable	VT_BSTR
canx.mtyy.OptionSpec	>20 / (all)	specification	readable	VT_UI1
canx.mtyy.HardwareILimit	all	hardware current limit	readable	VT_R4
canx.mtyy.HardwareVLimit	all	hardware voltage limit	readable	VT_R4
canx.mtyy.Supply24V	all	supply 24V	readable	VT_R4
canx.mtyy.Supply5V	all	supply 5V	readable	VT_R4
canx.mtyy.BoardTemp	all	board temperature	readable	VT_R4

fully qualified identifier	device class	description	access	type
canx.mtyy.ErrThreshold	all	threshold of error evaluation in percent of the nominal voltage	write-/ readable	VT_R4
canx.mtyy.ConfigRelFErr	0, 1, 2 / (all)	configuration mask of relay and regulation error	write-/ readable	VT_UI1
canx.mtyy.Polarity	5 / (all)	electronical polarity switch	write-/ readable	VT_UI1
canx.mtyy.Alive	all	module is alive	readable	VT_BOOL
canx.mtyy.DeviceClass	all	device class	readable	VT_UI1

5.2.1.5 Items to signal an alarm from the HV devices via Data Access

fully qualified identifier	device class	description	access	type
canx.mtyy.Alarm	all	alarm status	readable	VT_BOOL
canx.mtyy.AlarmInformation	all	alarm information	readable	VT_UI1

The items “Alarm” and “AlarmInformation” are implemented as event driven update inside of the ***isegHVOPCServer***. These two items are included (on request of Cern) in order to have an access to the fast alarm messages of the modules. The better way is to use the faster “Alarm & Event” part of the ***isegHVOPCServer***. Since version 4.01 the items as there are “Alarm” and “AlarmInformation” can be cleared by reset of the corresponding status bit. If an error occurs the “alarm status” will become to a *true* value. The error of the modules can be reset only by a reset of the reason of the error followed by writing a *‘1’* to the corresponding status bit.

The item “AlarmInformation” describes the kind of the alarm (see Hints to the item alarm information). The server refreshes „Alarm“ and „AlarmInformation“ if a new alarm is attempted but the client will register the new alarm only if the DA-value has been changed.

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
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Fax ++ 49 (0)351 / 26 996 - 21

5.2.1.6 Notes to the item *Status channel (EHQ)*

device classes 0, 1, 2

DATA_1 to DATA_0 bool array UI2

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
v	c	k	e	r	o	p	x	x	x	x	x	x	x	s	t

device class 6

DATA_1 to DATA_0 bool array UI2

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
v	c	x	e	r	o	p	x	x	x	x	x	x	x	x	t

device class 7

DATA_1 to DATA_0 bool array UI2

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
v	c	x	e	r	o	p	x	i	x	x	x	x	x	x	t

t	current trip	t = 0	channel is ok
		t = 1	V_O shut of 0V because software current trip has been exceeded
s	sum error	s = 0	channel is ok
		s = 1	detection of a sum error - consist of an OR between current and voltage limit error in time slots of 1ms, which means that it exists an error in the regulation of the channel, see to [(1)]
x	no information		
I	INHIBIT	i = 0	no INHIBIT channel is ok
		i = 1	detection of an INHIBIT if the HV is above the threshold to arm the error detection
p	input-error	p = 0	no input-error
		p = 1	wrong message to control the module
o	switch channel to	o = 0	channel OFF
		o = 1	channel ON
r	ramping	r = 0	voltage is stable
		r = 1	voltage ramps
e	emergency cut-off	e = 0	channel works
		e = 1	cut-off V_O shut off to 0V without ramp
k	kill function	k = 0	disable (see hardware current limit and software current trip)
		k = 1	enable (see hardware current limit and software current trip)
c	current limit error	c = 0	channel is ok
		c = 1	V_O shut off 0V because hardware current limit has been exceeded
v	voltage limit error	v = 0	channel is ok
		v = 1	V_O shut of permanently because voltage limit has been exceeded

For detection of a current or voltage limit error flag the firmware must evaluate the channel voltage at first.

5.2.1.7 Notes to the item *Channel status (EHS)*

canx.m*tyy*.chzz.Status channel status readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
isVLIM	isCLIM	isTRP	isEINH	isVBND	isCBND	res	res	isCV	isCC	isEMCY	isRAMP	isON	IERR	res	res

isVLIM	IsVoltageLimitExceeded	voltage limit set by V_{max} is exceeded
isCLIM	IsCurrentLimitExceeded	current limit set by I_{max} is exceeded
isTRP	IsTripExceeded	Trip is set when Voltage or Current limit or Iset has been exceeded (when KillEnable=1)
isEINH	IsExtInhibit	External Inhibit
isVBND	IsVoltageBoundsExceeded	Voltage out of bounds
isCBND	IsCurrentBoundsExceeded	Current out of bounds
isCV	IsControlledVoltage	Voltage control active
isCC	IsControlledCurrent	Current control active
isEMCY	IsEmergencyOff	Emergency off without ramp
isON	IsOn	On
isRAMP	IsRamping	Ramp is running
IERR	InputError	Input error
res	Reserved	

isVLIM=0 channel is ok
isVLIM=1 the hardware voltage limit is exceeded
isCLIM=0 channel is ok
isCLIM=1 the hardware current limit is exceeded
(to detect a hardware voltage or current limit error flag the firmware has to evaluate the channel voltage and current at first)
isTRP=0 channel is ok
isTRP=1 V_O is shut off to 0V without ramp because the channel has been tripped.
isEINH=0 channel is ok
isEINH=1 External Inhibit was scanned
isVBND=0 channel is ok
isVBND=1 |Vmeas-Vset| > Vbounds

isCBND=0 channel is ok
isCBND=1 |Imeas-Iset| > Ibounds (to detect a voltage or current out of bound flag the firmware has to ramp the channel voltage Vset at first)
isCV=1 channel is in state of voltage control
isCC=1 channel is in state of current control
isEMCY=1 channel is in state of emergency off, VO has been shut off to 0V without ramp
isON=0 channel is off
isON=1 channel voltage follows the Vset value
isRAMP=0 no voltage is in change
isRAMP=1 voltage is in change with the stored ramp speed value
IERR=0 no input-error
IERR=1 incorrect message to control the module

5.2.1.8 Notes to the items of the *Channel control (EHS)*

setOn	Set on channel
setEemergencyY	Set Emergency
doClear	Do clear events (EHS) or errors signals (EHQ) of the channel.

setEmergency = 0 reset Emergency
setEmergency =1 set Emergency (cut-off V_O shut off to 0V without ramp)

setOn = 0 switch the channel to OFF
setOn = 1 switch the channel to ON
(When Vset has been set to a value unequal to zero (0V) before the status bit 'isOn' is changed from (1) one to (0) zero a ramp down of the voltage to zero (0V) will be started.)

doClear=0 do nothing
doClear=1 reset the errors (EHQ), events (EHS) of the channels

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

5.2.1.9 Notes to the item *Channel event status (EHS)*

can*x*.m*tyy*.ch*zz*.EventStatus channel event status write-/ readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EVLIM	ECLIM	ETRP	EEINH	EVBNDs	ECBNDs	res	res	ECV	ECC	EEMCY	EEOR	EOn2Off	EIER	res	res

EVLIM	EventVoltageLimit	Event: Hardware- voltage limit has been exceeded
ECLIM	EventCurrentLimit	Event: Hardware- current limit has been exceeded
ETRP	EventTrip	Event: Trip is set when Voltage or Current limit or Iset has been exceeded (when KillEnable=1)
EEINH	EventExtInhibit	Event external Inhibit
EVBNDs	EventVoltageBounds	Event: Voltage out of bounds
ECBNDs	EventCurrentBounds	Event: Current out of bounds
ECV	EventControlledVoltage	Event: Voltage control
ECC	EventControlledCurrent	Event: Current control
EEMCY	EventEmergencyOff	Event: Emergency off
EEOR	EventEndOfRamp	Event: End of ramp
EOn2Off	EventOnToOff	Event: Change from state "On" to "Off"
EIER	EventInputError	Event: Input Error
res	Reserved	

An event bit is permanently set if the status bit is 1 or is changing to 1. Different to the status bit an event bit isn't automatically reset. A reset has to be done by the user by writing an 1 to this event bit.

5.2.1.10 Notes to the item *Channel event mask (EHS)*

can*x*.m*tyy*.ch*zz*.EventMask channel event mask write-/ readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit 9	Bit 8	Bit7	Bit6	Bit 5	Bit4	Bit3	Bit2	Bit 1	Bit0
MEVLIM	MECLIM	MECTRP	MEEINH	MEVBNDs	MECBNDs	res	res	MECV	MECC	res	MEEOR	MEOn2Off	MEIERR	res	res

MEVLIM	MaskEventVoltageLimit	EventMask: Hardware- voltage limit has been exceeded
MECLIM	MaskEventCurrentLimit	EventMask: Hardware- current limit has been exceeded
METRIP	MaskEventTrip	EventMask: Voltage limit or Current limit or Iset has been exceeded (when KillEnable=1)
MEEINH	MaskEventExtInhibit	EventMask: External Inhibit
MEVBNDs	MaskEventVoltageBounds	EventMask: Voltage out of bounds
MECBNDs	MaskEventCurrentBounds	EventMask: Current out of bounds
MECV	MaskEventControlledVoltage	EventMask: Voltage control
MECC	MaskEventControlledCurrent	EventMask: Current control
MEEMCY	MaskEventEmergencyOff	EventMask: Emergency off
MEEOR	MaskEventEndOfRamp	EventMask: End of ramp
MEOn2Off	MaskEventOnToOff	EventMask: Change from state on to off
MEIER	MaskEventInputError	EventMask: Input Error
res	Reserved	

5.2.1.11 Notes to the item *Module status (EHS)*

can*x*.m*tyy*.Status module status readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
isKILena	isTMPgd	isSPLYgd	isMODgd	isEVNTact	isSFLPgd	isnoRAMP	isnoSERR	res	res	isHwVLIMgd	isSrvc	res	res	res	isAdj

IsKILena	IsKillEnable	Module state of kill enable
isTMPgd	IsTemperatureGood	Module temperature good
isSPLYgd	IsSupplyGood	Power supply good
isMODgd	IsModuleGood	Module in state good
isEVNTact	IsEventActive	Any event is active and mask is set
isSFLPgd	IsSafetyLoopGood	Safety loop closed
isnoRAMP	IsNoRamp	All channels stable, no ramp active .
isnoSERR	IsNoSumError	Module without failure
isHwVLIMgd	IsHardwareVoltageLimitGood	Hardware voltage limit in proper range, only for HV distributor modules with current mirror;
IsSrvc	IsService	Hardware failure detected (consult iseg Spezialelektronik GmbH)
isADJ	IsFineAdjustment	Mode of the fine adjustment
res	Reserved	

isKILLena=0 Module in state kill disable
isKILLena=1 Module in state kill enable
isTMPgd=0 if module temperature is higher than 55°C then all channel are switched off permanently
isTMPgd=1 module temperature is within working range
isSPLYgd=0 supply voltages are out of range (range of 24V +/-10% and of 5V +/-5%)
isSPLYgd=1 supply voltages are within range
isMODgd=0 module is not good, that means (isnoSERR AND (ETMPngd OR ESPLYngd OR ESFLPngd))==0
isMODgd=1 module is good, that means (isnoSERR AND NOT(ETMPngd OR ESPLYngd OR ESFLPngd))==1
(see module event status also)
isEVNTact=0 no Event is active
isEVNTact=1 any Event is active
isSFLPgd=0 safety loop is broken -V_O bas been shut off,
isSFLPgd=1 safety loop is closed
isnoRAMP=0 V_O is ramping in at least one channel
isnoRAMP=1 no channel is ramping
isnoSERR=0 voltage limit, current limit, trip, voltage bound or current bound has been exceeded in at least one of the channels or external INHIBIT ⇒ error, reset by reset of the corresponding flag of the 'Channel Status'
isnoSERR=1 evaluation of the 'Channel Status' over all channels to a sum error flag
⇒ VLIM&CLIM&CTRP&EINH&VBND&CBND=0 ⇒ no errors
isHwVLIMgd=0 hardware voltage limit not in proper range
isHwVLIMgd=1 hardware voltage limit in proper range
isADJ=0 Fine adjustment is off.
isADJ=0 Fine adjustment is on (default)

5.2.1.12 Notes to the items of the *Module control (EHS)*

setAdjust	Set adjust	Switch ON of fine adjustment
setKillEnable	Set kill enable	Kill function
doClear	Clear events (EHS) and errors (EHQ)	Clear event (EHS) or error signals (EHQ) in the channels and the module

setAdjust = 0 fine adjustment OFF
setAdjust = 1 fine adjustment ON

setKillEnable = 0 kill function disable
setKillEnable = 1 kill function enable

doClear=0 do nothing
doClear=1 reset the errors (EHQ), events (EHS) of the channels

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

5.2.1.13 Notes to the item *Module event status (EHS)*

can*x*.m*tyy*.EventStatus module event status write-/ readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
res	ETMPngd	ESPLYngd	res	res	ESFLPngd	res	res	res	res	res	res	res	res	res	res

ETMPngd	EventTemperatureNotGood	Event: Temperature is above 55°C
ESPLYngd	EventSupplyNotGood	Event: at least one of the supplies is not good
ESFLPngd	EventSafetyLoopNotGood	Event: Safety loop is open
res	Reserved	

5.2.1.14 Notes to the item *Module event mask (EHS)*

can*x*.m*tyy*.EventMask module event mask write-/ readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
res	METMPngd	MESPLYngd	res	res	MESFLPngd	res	res	res	res	res	res	res	res	res	res

METMPngd	MaskEventTemperatureNotGood	MEventMask: Temperature is above 55°C
MESPLYngd	MaskEventSupplyNotGood	MEventMask: at least one of the supplies is not good
MESFLPngd	MaskEventSafetyLoopNotGood	MEventMask: Safety loop (SL) is open
res	Reserved	

5.2.1.15 Notes to the item *Event channel status (EHS)*

can*x*.m*tyy*.EventChannelStatus event channel status write-/ readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
CH15	CH14	Ch13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

The n-th bit of the register is set, if an event is active in the n-th channel and the associated bit in the EventMask register of the n-th channel is set too.

CHn = EventStatus[n] & EventMask[n]

Reset of a bit is done by writing a 1 to this bit.

5.2.1.16 Notes to the item *Event channel mask (EHS)*

can*x*.m*tyy*.EventChannelMask event channel mask write-/ readable VT_UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
CH15	CH14	Ch13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

This register decides whether a pending event leads to the sum event flag of the module or not. If the n-th bit of the mask is set and the n-th channel has an active event in the EventChannelStatus the bit isEventActive in the ModuleStatus register is set

5.2.1.17 Notes to the item *General status (EHQ)*

can*x*.m*tyy*.GeneralStat general status readable VT_UI1

b7	b6	b5	b4	b3	b2	b1	b0
save	killena/ hwVLimNoExceed	vsply	avad	stbl	sloop	nramp	sum

sum	sum error flag	sum = 0	voltage limit, current limit or trip were exceeded in the module
		sum = 1	status channel flags v & c & t = 0 for all channels
nramp	no ramp flag	nramp = 0	V_O is ramping at least one channel
		nramp = 1	no channel is ramping
sloop	safety loop flag	sloop = 0	safety loop is broken -V_O has been shut off, clear this bit by reading the general status information
		sloop = 1	safety loop is closed
stbl	stable	stbl = 0	all channels are stable with programmable ADC filter frequency f_N (ADC conversion time =1 / f_N, see 'ADC filter frequency setting', default f_N = 50 Hz)
		stbl = 1	at least one channel is ramping V_O or not yet stable after ramping (with ADC filter frequency f_N = 100 Hz)
avad	average adjust	avad=0	fine adjustment OFF for device classes 0, 6 and 7 average of voltage and current measurement OFF for device classes 1, 2 and 7
		avad=1	fine adjustment ON for device classes 0, 6 and 7 average of voltage and current measurement ON for device classes 1, 2 and 7
vsply	supply voltages	vsply=0	supply voltages or module temperature are out of range
		vsply=1	supply voltages and module temperature are in range
killena	kill enable	killena=0	kill function disable, only at modules of device class 6 and 7
		killena=1	kill function enable only at modules of device class 6 and 7
hwVLimNoExceed		=0	hardware voltage limit to "Low", only at modules of device class 0
		=1	hardware voltage limit in a proper range, only at modules of device class 0
save	save set values	save=0	no write access to EEPROM
		save=1	store all set values to EEPROM (time to save ca. 10s)

sn. serial numbers

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

5.2.1.18 Notes to the items *VsetAllChannels*, *ITripAllChannels* and *ISetAllChannels*

All items are readable since isegHVOPCServer release 4.10. The item VsetAllChannels, ITripAllChannels and IsetAllChannels has been implemented for a fast possibility to set all channel items of the same kind such as VSet on a value. The read access of the OPC items VsetAllChannels, ITripAllChannels and IsetAllChannels deliver only the value from cache of the OPC server, which has been written as last. The really value of the channel items can be differ for instance in case of a mix module or a hardware limit and others but the channel items VSet, ITrip and ISet contain always the proper values.

5.2.1.19 Notes to the item *Configuration of the relay and regulation error*

canx.m*t*yy.ConfigRelFErr configuration of relay and regulation error write-/readable VT_UI1

b7	b6	b5	b4	b3	b2	b1	b0
x	dcRACRO	dcRACSO	dcRREr r	dcRSLp	dcRTErr	dcRVErr	dcRIErr

dcRIErr 1 discharge if the hardware current limit was exceeded for at least one channel
0 no discharging with help of the relay

dcRVErr 1 discharge if the hardware voltage limit was exceeded for at least one channel
0 no discharging with help of the relay

dcRTErr 1 discharge if the software current trip was exceeded for at least one channel
0 no discharging with help of the relay

dcRSLp 1 discharge if the safety loop has been disconnected, the output voltages are shut off without ramp
0 no discharging with help of the relay
(If the safety loop has been disconnected, the set voltages are shut off with the actual ramp speed.)

dcRREr 1 discharge if the regulation was out of order for at least one channel (reaction >= 1ms)
0 no discharging with help of the relay

dcRACSO 1 discharge if all channels set to “OFF”(Group access module “Channel ON/OFF” or “Emergency cut-off”) - ***is working only if the dcRACRO bit has been set also***
0 no discharging with help of the relay
(ramp down the set voltages with the actual ramp speed)

dcRACRO 1 discharge if all channels set to “OFF” (Group access module “Channel ON/OFF” and the end of ramping has been reached or “Emergency cut-off”)
0 no discharging with help of the relay
(when the set voltages of all channels are set to “OFF”)

Under the setting of one of these conditions and the corresponding error occurs following will happen:

- shut off the HV without ramp in all channels and the set voltage in all channels to 0V by software.
- close contact of discharge relay.

The relay contacts will discharge capacities connected to the output with help of an integrated load resistor (see Appendix B Operators Manual - Multi-channel High Voltage Power Supply EHQ). This item configures the conditions of how this does work.

Under the setting of one of these conditions and the corresponding error occurs following will happen:

- shut off the HV without ramp in all channels and the set voltage in all channels to 0V by software.

- close contact of discharge relay.

5.2.1.20 Notes to *GroupNumber* and *GroupVariable (EHS)*

With mean of the item GroupNumber is it possible to access to one of the 32 variable group functions.

Each variable group definition will set via the item GroupVariable. The item GroupVariable consists out of 2 words each of 16 bits. In variable groups one word carries the information about the members of the group or gives an overview about a selected situation in all channels, the other word carries the information about type and characteristics of the goup.

Set group:

Set groups will be used in order to set channels to a same value, which happen to carry the identical channel value. Therefore within the group following will be defined:

- Member of the group: Each member will be activated in the channel setting list **ChSetLst**
- Type of the group: Set group type **TypeSet**
- Channel characteristics: Coding of characteristics, which have to be set commonly
- Control mode: Divides between a one-time setting of the slave channel property and a permanently copying of the Master channel's property to the slave channels
- Master channel: Number of the channel, which characteristics will be transferred to the other channels. Is just necessary for Set groups which set a value. If functions have to be initialized e.g. start of ramp then there is no Master channel

ChSetLst				ChannelSettingList											UI2
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0
TypeSet				DATA_0 to DATA_1 TypeSet											UI2
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
TYPE1	TYPE0	res	res	res	res	res	MOD0	SET3	SET2	SET1	SET0	MCH3	MCH2	MCH1	MCH0

TYPE1	TYPE0	Value	
0	0	SetGroupType	Group is defined as Set group

MOD0	Value	
0	0	The group function is done one time
1	1	The group function is done permanently

SET3	SET2	SET1	SET0	Value	
0	0	0	1	SetVset	Copy Vset from MCH to all members
0	0	1	0	SetIset	Copy Iset from MCH to all members
0	1	0	0	SetVbnds	Copy Vbounds from MCH to all members
0	1	0	1	SetIbnds	Copy Ibounds from MCH to all members
1	0	1	0	SetOn	Switch ON/OFF all members depending on setON in MCH
1	0	1	1	SetEmrgCutOff	Switch OFF all members (Emergeny OFF)
1	1	1	1	Cloning	Set all properties of members like MCH properties *(in preparation)*

MCH3	MCH2	MCH1	MCH0	Value	
0	0	0	0	0	1: Channel 0 is MasterChannel MCH
0	0	0	1	1	1: Channel 1 is MasterChannel MCH
...	...	...	...	...	...
1	1	1	1	15	1: Channel 15 ist MasterChannel MCH

Status group:
Status groups are used to report the status of a single characteristic of all channels simultaneously. No action is foreseen. Therefore within the group following has to be defined :
Members of the group: Each member will be activated in the channel status list **ChStatLst.**
Type of the group: Status group type **TypeStat**
Channel characteristics:Coding of characteristics , which is to be reported.

ChStatLst					ChannelStatusList											UI2
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16	
CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
TypeStat					DATA_0 to DATA_1 TypeStatus											UI2
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
TYPE1	TYPE0	res	res	res	res	res	res	STAT3	STAT2	STAT1	STAT0	res	res	res	res	

TYPE1	TYPE0	Value	
0	1	StatusGroupType	Group will be defined as Status group

STAT3	STAT2	STAT1	STAT0	Value	
0	0	1	1	ChkIsOn	check channel Status.isON (is on)
0	1	0	0	ChkIsRamping	check channel Status.isRAMP (is ramping)
0	1	1	0	ChkIsControlledCurrent	check channel Status.isCC (is current control)
0	1	1	1	ChkIsControlledVoltage	check channel Status.isCV (is voltage control)
1	0	1	0	ChkIsCurrentBounds	check channel Status.isCBNDs (is current bounds)
1	0	1	1	ChkIsVoltageBounds	check channel Status.isVBNDs (is voltage bounds)
1	1	0	0	ChkIsExternalInhibit	check channel Status.isEINH (is external inhibit)
1	1	0	1	ChkIsTrip	check channel Status.isTRIP(is trip)
1	1	1	0	ChkIsCurrentLimit	check channel Status.isCLIM (is current limit exceeded)
1	1	1	1	ChkIsVoltageLimit	check channel Status.isVLIM (is voltage limit exceeded)

Monitoring group:
Monitoring groups are used to observe a single characteristic of selected channels simultaneously and in case of need take action. Therefore the group has to be defined :
Members of the group: Each member will be activated in the channel monitoring list **ChMonLst.**
Type of the group: Monitoring group type **TypeMon**
Channel characteristics:Coding of characteristics , which is to be monitored.
Control mode: Coding of the control function, i.e. which kind of change in the group-image shall cause a signal.
Activity: Define , which activity has to happen after the event.

ChMonLst					ChannelMonitoringList											UI2
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16	
CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
TypeMon					DATA_0 to DATA_1 TypeMonitoring											UI2
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
TYPE1	TYPE0	ACT1	ACT0	res	res	res	MOD0	MON3	MON2	MON1	MON0	res	res	res	res	

TYPE1	TYPE0	Value	
1	0	MonitoringGroupType	Group will be defined as Monitoring group

ACT1	ACT0	Value	
0	0	0	No special action ; EventGroupStatus[grp] will be set
0	1	1	Ramp down of group EventGroupStatus[grp] will be set
1	0	2	Switch OFF of group without ramp; EventGroupStatus[grp] will be set
1	1	3	Switch OFF of module without ramp; EventGroupStatus[grp] will be set

MOD0	Value	
0	0	event will happen if at least one Channel == 0
1	1	event will happen if at least one Channel == 1

MON3	MON2	MON1	MON0	Value	
0	0	1	1	MonitorIsOn	monitor channel Status.isON (is on)
0	1	0	0	MonitorIsRamping	monitor channel Status.isRAMP (is ramping)
0	1	1	0	MonitorIsControlledCurrent	monitor channel Status.isCC (is current control)
0	1	1	1	MonitorIsControlledVoltage	monitor channel Status.isCV (is voltage control)
1	0	1	0	MonitorIsCurrentBounds	monitor channel Status.isCBNDs (is current bounds)
1	0	1	1	MonitorIsVoltageBounds	monitor channel Status.isVBNDs (is voltage bounds)
1	1	0	0	MonitorIsExternalInhibit	monitor channel Status.isEINH (is external inhibit)
1	1	0	1	MonitorIsTrip	monitor channel Status.isTRIP (is trip)
1	1	1	0	MonitorIsCurrentLimit	monitor channel Status.isCLIM (is current limit exceeded)
1	1	1	1	MonitorIsVoltageLimit	monitor channel Status.isVLIM (is voltage limit exceeded)

Delayed Trip group:
Trip timeout groups are necessary to keep the timing for the time controlled delayed Trip function and to define the action which has to happen after a Trip.

Therefore in the group following will be defined:

- Members of group: Each member will be activated in a word channel trip timeout list **ChTrpTotLst.**
- Type of the group: Time out group type **TypeTime**
- Activity: Define , which activity has to happen after time controlled Trip
- Timeout: Coding of Timeout-time as 12 Bit Integer.

Timeout groups have to stay unchanged for the whole time as long they are used.
An overwriting will cause the definition of a new group. An overlay of the channels of multiple Trip groups is not allowed.

ChTrpTotLst				ChannelTripTimoutList											UI2
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0
TypeTime				DATA_0 to DATA_1 TypeTimeOut											UI2
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
TYPE1	TYPE0	ACT1	ACT0	TOT11	TOT10	TOT9	TOT8	TOT7	TOT6	TOT5	TOT4	TOT3	TOT2	TOT1	TOT0

TYPE1	TYPE0	Value	
1	1	TimeOutGroupType	Group will be defined as Timeout group

ACT1	ACT0	Action	
0	0	0	No special action; EventGroupStatus[grp] will be set.
0	1	1	Ramp down of group with ramp; EventGroupStatus[grp] will be set
1	0	2	Switch OFF the group without ramp; EventGroupStatus[grp] will be set
1	1	3	Switch OFF the module without ramp; EventGroupStatus[grp] will be set

TOT[11..0]:	Binary coded Timeout-time in ms (8..4088ms) resolution is 8ms

5.2.1.21 Notes to the item *Alarm information*

canx.mtyy.AlarmInformation alarm status readable VT_UI1

b7	b6	b5	b4	b3	b2	b1	b0
$HwV_{Limit\_to\_low}$ / INHIBIT	M_{Temp}	V_{Supl}	S_{Loop}	V_{Limit}	C_{Limit}	R_{Error}	C_{Trip}

C_{Trip}	current trip	C_{Trip} = 0 ⇒ no channel has tripped C_{Trip} = 1 ⇒ software current trip at least one of the channels
R_{Err}	regulation error	R_{Error} = 0 ⇒ no channel has a regulation error (see channel status) R_{Error} = 1 ⇒ at least one of the channels has detected a regulation error
C_{Limit}	current limit	C_{Limit} = 0 ⇒ no channel has exceeded the hardware current limit C_{Limit} = 1 ⇒ at least one of the channels has exceeded the current limit
V_{Limit}	voltage limit	V_{Limit} = 0 ⇒ no channel has exceeded the voltage limit V_{Limit} = 1 ⇒ at least one of the channels has exceeded the voltage limit
S_{Loop}	safety loop	S_{Loop} = 0 ⇒ safety loop is closed S_{Loop} = 1 ⇒ safety loop is broken
V_{supl}	voltage supplies	V_{supl} = 0 ⇒ supply voltages are in range V_{supl} = 1 ⇒ supply voltages are out of range
M_{Temp}	module temperature	M_{Temp} = 0 ⇒ module temperature <= 60°C, no action M_{Temp} = 1 ⇒ module temperature > 60°C, HV has been switched off
$HwV_{Limit\_to\_low}$	(device class 0 only)	$HwV_{Limit\_to\_low}$ = 0 ⇒ hardware voltage limit in range $HwV_{Limit\_to\_low}$ = 1 ⇒ hardware voltage limit to low - it is not possible to switch on any channel
INHIBIT (device class 7 only)		INHIBIT = 0 ⇒ no channel has detected an INHIBIT INHIBIT = 1 ⇒ at least one of the channels has detected an INHIBIT

5.2.1.22 Notes to the item *Option (EHS)*

canx.mtyy.Option option readable VT_BSTR

Option	Description	Specification
“EDCP”	Enhanced Device Control Protocol	no
“HVBM”	HV boards per (CAN nodes) module	no
“CLIM”	hardware current limit	no
“VLIM”	hardware voltage limit	no
”INHB”	external INHIBIT signals	no
“RELY”	discharge relay	no
“FRMP”	fast ramp	yes (1 - 25% of Nominal V, 2 - 50% of Nominal V, 3 - 75% of Nominal V)
“NIPL”	not implemented	

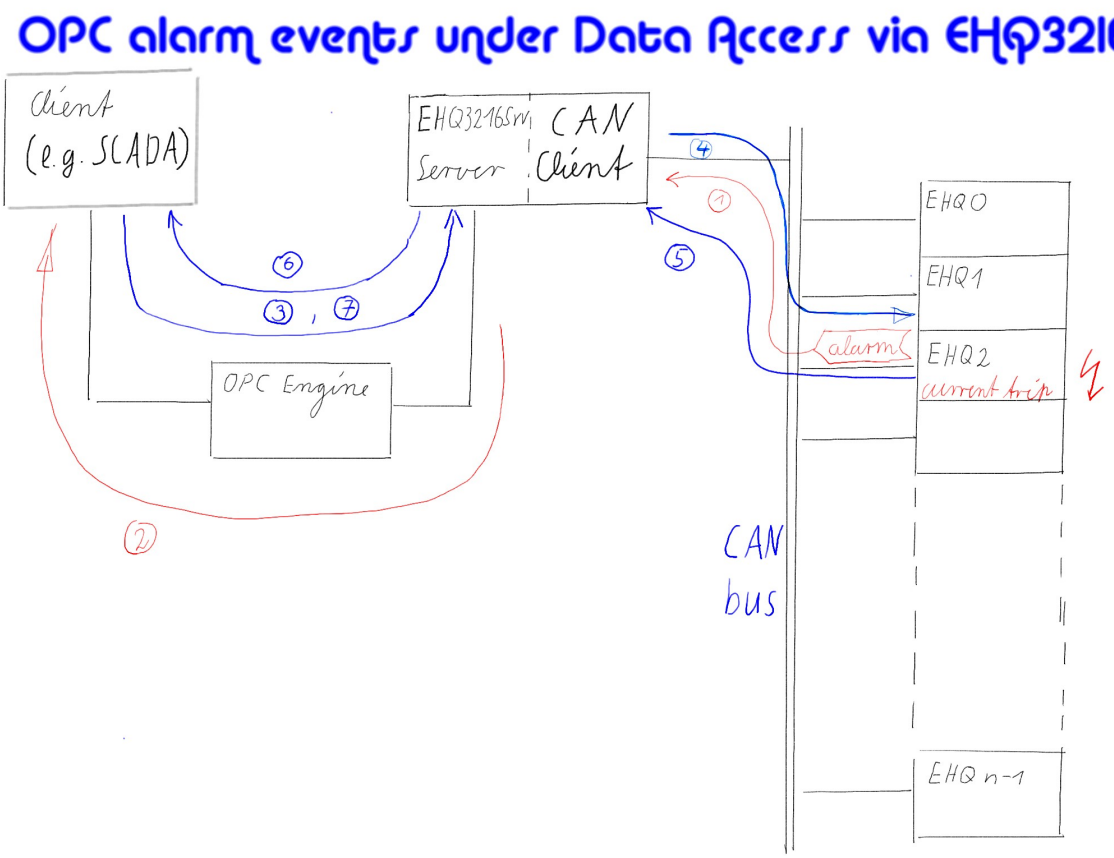
5.2.1.23 Notes to *OptionSingleSpec (EHS)*

In order to request the specification of one option item *OptionSpec* the corresponding option string have to be written to the item *OptionSingleSpec.*

5.2.1.24 Items for public groups defined by the OPC server:

GroupDeviceID	list of all device identifiers	readable	VT_BSTR
GroupSoftwareID	list of all software identifiers	readable	VT_BSTR
GroupStatHardwareILimit	list of all status current limits	readable	VT_UI2
GroupStatHardwareVLimit	list of all status voltage limits	readable	VT_UI2
GroupStatITrip	list of all status current trips	readable	VT_UI2
GroupStatRegulationErr	list of all status regulation errors	readable	VT_UI2
GroupGeneralSumError	list of all sum errors	readable	VT_BOOL
GroupGeneralStable	list of all stable status	readable	VT_BOOL
GroupGeneralSafetyLoop	list of all safety loop status	readable	VT_BOOL
GroupGeneralFineAdjust	list of all fine adjustment flags	readable	VT_BOOL
GroupGeneralHwVLimitLow	list of all HW voltage limit tow low flags	readable	VT_BOOL
GroupBitRate	list of bit rates that are stored in modules	readable	VT_UI2
GroupErrThreshold	list error thresholds	readable	VT_UI2
GroupConfigRelFErr	list of bit mask for relay configurations	readable	VT_UI2
GroupAlarm	list of all alarm status information	readable	VT_BOOL
GroupAlive	list of all alive information	readable	VT_BOOL

If an error occurs it will be signalled by the item *alarm status* in connection with the check of the sum error flag from the item GeneralStat (GeneralStatSumError). These items will catch the errors by read and they will cancel the errors by write with the corresponding channel flag is set to “1”.



(1) A current trip happens and will generate one CAN alarm message with higher priority as the normal messages of the data transfer.

(2) The ***isegHVOPCServer*** sets the item Alarm to TRUE and gives a note of the kind of the alarm by the item “AlarmInformation” (both were build as a reported item in the name space).

(3, 4, 5, 6) The Client has to read which channel has tripped and is able to cancel the error flag by a write of the item “StatITrip” with the corresponding channel flag is set to “1”.

(7) Not necessary up to version 4.0.

5.2.2 Alarms and Events server

The OPC server offers the “Alarms & Events” feature built into the same executable in order to let the OPC client act quickly on a single event or an alarm.

The following alarms and events have been defined:

5.2.2.1 Simple events

canx.ErrorSafetyLoop	error status of safety loop	readable
canx.ErrorSupply	error status of supply voltages	readable
canx.ErrorSumError	error status of general sum status	readable

5.2.2.2 Tracking events

Computer.KeyboardPressed	access to local keyboard on server	readable
Computer.MouseActivity	access to local mouse on server	readable

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

6 OPC server part for iseg system crate *ECHx38*

The OPC server has been developed using the following tools:

- Softing OPC Toolkit, Ver. 4.0 DA3.0
- Microsoft Visual C++, Ver. 6.01
- PEAK System CAN device driver

The executable is included in ***isegHVOPCServer.exe*** also as OPC “Data Access” server and “Alarm and Event” server.

6.1 Configuration

The OPC server has to be configured at the beginning. It must get all information about the kind of **iseg** HV hardware connected to the CAN bus. This information is stored into the configuration file. The tool ***isegHVOPCcfg.exe*** is used to create this configuration file. It performs a scan on the CAN bus and collects information from the connected CAN nodes (modules and crates). Also it supports the graphical access to the initialising file ***isegHVOPCServer.ini***.
For further details see the configuration manual ***isegHVOPCSetup.pdf***.

6.2 Data Access Server and Alarm and Event Server

6.2.1 Data Access Server

The OPC (DA) server is made to work with more than one crate. Therefore each property of the **iseg** system crate has to be addressed in a geographical way to build a fully qualified item ID that means:

CANBUS.CRATE.ITEMNAME

The properties in the OPC server are defined as items. In the simplest case, such an item is directly coupled to a read or write via CAN bus. The “On” is an example. The OPC “Data Access” method is working via request queues.

6.2.1.1 Items of the releases from the server components

6.2.1.2 Items of Data Access

Syntax: *x* Є [0..15] number of the CAN bus
yy Є [0..63] number of the CAN node

can*x*.crate*yy*.Supply24V	crate power 24V	readable	VT_R4
can*x*.crate*yy*.Supply5V	crate power 5V	readable	VT_R4
can*x*.crate*yy*.Battery	battery voltage for the UPS ca. 24V	readable	VT_R4
can*x*.crate*yy*.TempBackPlane	temperature on the back plane	readable	VT_R4
can*x*.crate*yy*.TempPowerSupply	temperature on the DC/DC converter	readable	VT_R4
can*x*.crate*yy*.FanStageBackPlane	stage on the back plane fan unit	readable	VT_UI1
can*x*.crate*yy*.FanStagePowerSupply	stage on the crate power supply fan unit	readable	VT_UI1
canx.crate*yy*.Status	crate power status	write-/readable	VT_UI1
canx.crate*yy*.StatusACLinePower	status of the AC line power	write-/readable	VT_BOOL
can*x*.crate*yy*.On	status of the power	write-/readable	VT_BOOL
can*x*.crate*yy*.DeviceID	device identifier	readable	VT_BSTR
can*x*.crate*yy*.SoftwareID	software release	readable	VT_BSTR
can*x*.crate*yy*.BitRate	bit rate	readable	VT_UI2
can*x*.crate*yy*.Alive	crate is alive	readable	VT_BOOL
canx.crate*yy*.AlarmFlag	alarm status	readable	VT_BOOL
canx.crate*yy*.AlarmInformation	alarm information	readable	VT_BSTR

When the AlarmFlag goes true the item value of AlarmInformation will get one of the following strings:
“EMCY supply 24V”
“EMCY supply 5V”
“EMCY battery 24V”
“Temperature PS”
“Temperature BP”
“AC line power”

If there are more than one alarm sources the item value will display the latest received alarm. With help of the status items it will display all received alarms. It has to reset an alarm by write a one to the corresponding status bit of the Status item or a true to the StatusACLinePower item.

canx.crate*yy*.AlarmValue	alarm value	readable	VT_R4

alarm information – “EMCY supply 24V”	*measurement supply 24V*
alarm information – “EMCY supply 5V”	*measurement supply 5V*
alarm information – “EMCY battery 24V”	*measurement 24V battery voltage*
alarm information – “Temperature PS”	*measurement Temperature PS*
alarm information – “Temperature BP”	*measurement Temperature BP*
alarm information – “AC line power”	*nothing - 0*

The items “AlarmFlag”, “AlarmInformation” and “AlarmValue” are implemented as event driven update inside of the ***isegHVOPCServer***. The “AlarmFlag” will become a true if an error occurs. The “AlarmValue” is the corresponding measurement to the “AlarmInformation” item. The “AlarmInformation” describes the kind of the alarm (see Hints to the item AlarmInformation). The alarm will be generated with help of EMCY ID (see manual ***ECH-CANwithUPS_eng.pdf***). The crate will repeat the alarm trigger until the error will go away. These items are included (on request of Cern) in order to have an access to the fast alarm messages of the crates. The better way is to use the faster “Alarm & Event” part of the ***isegHVOPCServer***. Since version 4.01 the items as there are “AlarmFlag”, “AlarmInformation” and “AlarmValue” can be cleared by reset of the corresponding status

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21

bit. The error of the crate can be reset only by a reset of the reason of the error followed by writing a *'1'* to the corresponding status bit.

The "Alarm Flag", "AlarmInformation" and "AlarmValue" will refreshed by the server if a new alarm is attempted but the client will register the new alarm only if the DA-value has been changed.

6.2.1.3 Crate power status

Capture status if voltages were out of range.

b7	b6	b5	b4	b3	b2	b1	b0
temperature to high		+24V to high	+24V to low	+5V to high	+5V to low	24V battery to high	24V battery to low

6.2.2 Alarm and Events Server

The OPC server offers the 'Alarms & Events' feature built into the same executable in order to let the OPC client act quickly on a single event or an alarm.

The following alarms and events have been defined:

Simple events:

canx.ErrorSupply24V	error of supply 24V	readable
canx.ErrorSupply5V	error of supply 5V	readable
canx.ErrorBattery24V	error of battery 24V (possible only if the crate power is off)	readable
canx.ErrorTemperaturePS	error of temperature senor on power supply 24V-DC-PS	readable
canx.ErrorTemperatureBP	error of temperature sensor on pack plane	readable
canx.ErrorACline_power	error of AC line power	readable

Tracking events:

Computer.KeyboardPressed	access to local keyboard on server	readable
Computer.MouseActivity	access to local mouse on server	readable

Appendix A

Following items will refreshed via the background cycle:

canx.mtyy.GeneralStat
canx.mtyy.Status
canx.mtyy.EventStatus
canx.mtyy.EventMask
canx.mtyy.EventChannelStatus
canx.mtyy.EventChannelMask
canx.mtyy.RampSpeed
canx.mtyy.IRampSpeed
canx.mtyy.On
canx.mtyy.Emcy
canx.mtyy.StatHardwareVLimit
canx.mtyy.StatHardwareILimit
canx.mtyy.StatITrip
canx.mtyy.StatINHIBIT
canx.mtyy.StatRegulationErr
canx.mtyy.HardwareVLimit
canx.mtyy HardwareILimit
canx.mtyy.Supply24V
canx.mtyy.Supply5V
canx.mtyy.BoardTemp
canx.mtyy.ErrThreshold
canx.mtyy.ConfigRelFErr

canx.mtyy.chzz.Vset
canx.mtyy.chzz.VMeas
canx.mtyy.chzz.Iset
canx.mtyy.chzz.Itrip
canx.mtyy.chzz.IMeas
canx.mtyy.chzz.Stat
canx.mtyy.chzz.Status
canx.mtyy.chzz.EventStatus
canx.mtyy.chzz.EventMask

iseg Spezialelektronik GmbH
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Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 (0)351 / 26 996 - 0
Fax ++ 49 (0)351 / 26 996 - 21