Overview on iseg Multi-Channel High Voltage system

Document: **isegHVSystem** Version: **1.12** Date: **08.12.2006 10:39**

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

Table of Contents

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

System Overview on iseg Multi-Channel High Voltage Sources

1 iseg system of multichannel highvoltage sources

The basic system idea of iseg Multi-Channel High Voltage (HV) PS modules is the design of high grade HV sources with small dimensions and high flexibility. Beside the actual highvoltage sources, that are pooled in groups to 8, 16 or 32 HV sources into one module, further components like crates, crate controllers and the control software belong to the iseg HV system.

The Multi-Channel HV modules can be used in System crates or even standalone. In very small systems or test equipment, the modules can work without crates driven by Lab PS, i.e. small systems can be built with low initial costs
Due to the low cost for crates and the high density per channel cost per channel are very moderate.

In order to control both the modules and the crate controllers the serial CAN Interface is used (CAN = controller area network, also named CAN bus).

In applications without using crates the needed supply voltages and the CAN bus signals have to be connected at the rear panel system connector (96pin) directly. The connections can also be made by the user himself but even more simple is it with a special adapter named “test adapter HV module” from iseg, providing the necessary connections (supply cables, CAN bus connector) for use in laboratory equipment.

In crate bins the necessary supply voltages are provided by the common PS. The CAN bus is connected through the back plane to the front of the crate controller.

The crate controller has to monitor the functions of the crate (correct values of i.e. voltage and temperature). with a separate CAN bus connection to two CAN bus connectors at the front side of the crate controller.

In small systems - having a single CAN bus segment only - the back plane CAN segment can be connected to the CAN segment of the controller. In bigger systems the control and monitoring of high voltage parameters can be separated from the control of the crates by separating the CAN bus on the back plane from the CAN bus of the crate controller.

2 Addressing of iseg devices in the CAN bus

Data transmission between iseg devices (HV modules, crate controller, I/O modules) uses the CAN bus corresponding to standard CAN 2.0B (passive). Data exchange is done by data grams according to the rules of the iseg firm device control protocol DSP. Detailed information about the control functions of modules and devices is given in the manuals.

Since the focus has to be set to the whole system the addressing will be shown as follows:

Addressing of a data gram is done in the identifier of a CAN data frame. The CAN standard describes an identifier of 11 bits. These bits are used as follows:

Table 1: Identifier of the iseg device control protocol

	dominant (0)	recessive (1)
ID 10	HV module	crate controller
ID 9	module sends an alarm	normal data transmission
ID 8	address 5	
ID 7	address 4	
ID 6	address 3	
ID 5	address 2	
ID 4	address 1	
ID 3	address 0	
ID 2	reserved	reserved
ID 1	basic function	extended function
ID 0	write	read

The higher 8 bit (ID10..ID3) contain the acceptance filter of the CAN bus. These 8 bit allow a hardware filter of all CAN frames. Only those frames matching the acceptance filter are processed in the module. The lower bits ID2..ID0 contain extended information to the module commands, which have been described in detail in the manuals.

Table 1 shows that the addressing can be made for up to 64 CAN nodes of each type (module or controller) in one CAN bus segment. Participating in the bus the nodes can be passive (ID9 = recessive) or active (ID9 = dominant). The last case is necessary for fast actions on alarm events. Then such a node can actively send a message to the administrating unit (like a look-at-me LAM).

The identifier bits ID8..ID3 hold the information, which node has to process the frame or from which node the frame comes. A detailed description of the setting of these identifier bits in iseg Multi-Channel HV modules and crate controller is given in the next paragraphs.

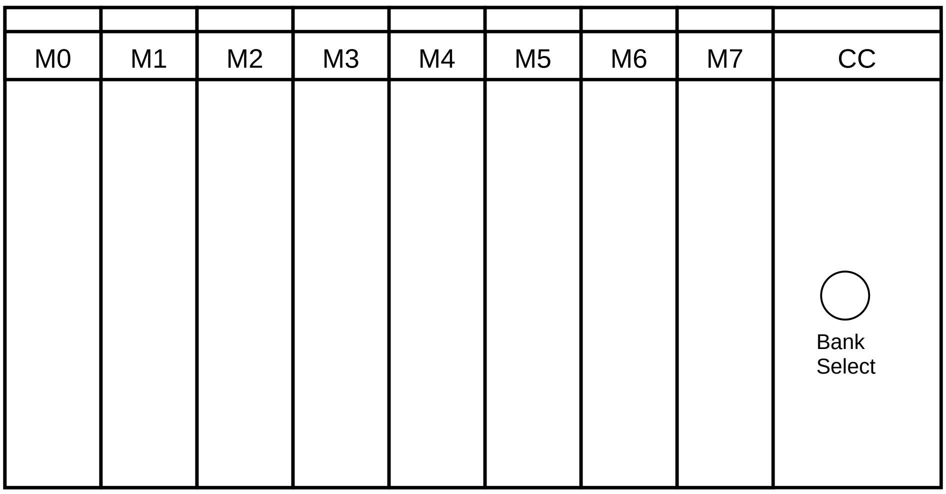
2.1 Addresses of modules

The setting of the addresses of the iseg Multi-Channel HV modules is done by setting the 6 address pins at the system connector. From these address pins (A5..A0) the module gets the basic information to process the relating identifier bits ID8..ID3.

In the iseg system crate the 6 address pins are set in two parts The first part (A5..A3) is the same for all modules in the crate. It is set via a so called “Bank Select” switch at the front side of the crate controller. The second part is to distinguish the modules in the crate. Therefore each position where a module can be plugged in (a so called “slot”) has it’s own combination of the bits A2..A0,
shown in picture 1.

With other words, the crate gives the module 6 address bits (called BS2..BS0, SL2..SL0 in the crate; called A5..A0 in the module). These bits are interpreted by the module into the identifier bits ID8..ID3. These identifier bits are the address bits for the communication of the modules via CAN bus.
This algorithm for computing the identifier bits depends on the type of the module. It is described as follows:

Crate
(schematic)



module pin									
A0	0	1	0	1	0	1	0	1	fix, named SL0
A1	0	0	1	1	0	0	1	1	fix, named SL1
A2	0	0	0	0	1	1	1	1	fix, named SL2
A3	BS0	BS0	BS0	BS0	BS0	BS0	BS0	BS0	} set by the switch “Bank Select”
A4	BS1	BS1	BS1	BS1	BS1	BS1	BS1	BS1	
A5	BS2	BS2	BS2	BS2	BS2	BS2	BS2	BS2	

Pict. 1: Coding of the address pins at crate positions

2.1.1 Generation of identifier bits ID8..ID3 in the iseg Multi-Channel HV modules

The iseg Multi-Channel HV modules can have one or two CAN nodes. There are 8- and 16-channel modules having one CAN node, and 16- and 32-channel modules having two CAN nodes. Both module types differ totally how they generate the identifier bits out of the address pins. The reason is that there is only one slot address per slot, but in it can be one or two nodes – as one module - plugged into one slot.

2.1.1.1 Modules having one CAN node

In modules having one CAN node generate their identifier bits ID8..ID3 directly from the information they get from module pin A5..A0. This information is given from the crate signals BS2..BS0 and SL2..SL0. Table 2 shows this in detail:

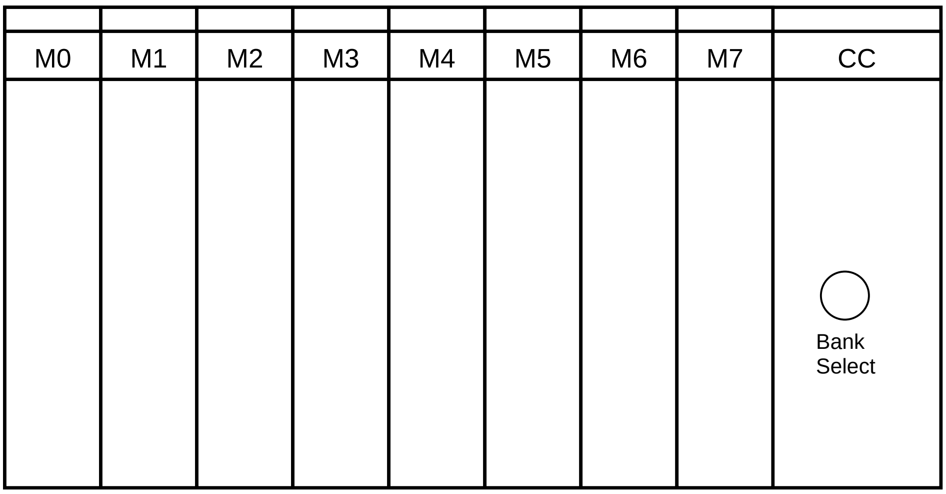
Table 2: Generation of the identifier address information inside a one-node CAN module

module pin	A5	A4	A3	A2	A1	A0
signal of the crate	BS2	BS1	BS0	SL2	SL1	SL0
identifier bit	ID8	ID7	ID6	ID5	ID4	ID3

Picture 2 shows the identifiers of a crate having “One node” CAN modules.
The bank select switch is set to 2. Showing a simple example the other Identifier bits should be set to:

ID10	dominant	HV module
ID9	recessive	normal data transmission
ID2	dominant	reserved
ID1	dominant	basic function
ID0	dominant	write

Crate
(schematic)



module pin									
A0	0	1	0	1	0	1	0	1	fix SL0
A1	0	0	1	1	0	0	1	1	fix SL1
A2	0	0	0	0	1	1	1	1	fix SL2
A3	0	0	0	0	0	0	0	0	set by the switch “Bank Select”
A4	1	1	1	1	1	1	1	1	
A5	0	0	0	0	0	0	0	0	
ID (hex)	**280**	**288**	**290**	**298**	**2A0**	**2A8**	**2B0**	**2B8**	

Pict. 2: identifiers in a crate with “ One-Node” CAN modules

Detail: Generation of the ID of module M0

ID10	ID9	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
HVM	norm	BS2	BS1	BS0	SL2	SL1	SL0	res	Basis	Schr.
0	1	0	1	0	0	0	0	0	0	0
2			8				0			

2.1.1.2 Modules containing two CAN nodes

Like shown before, there is only one slot information per slot. In order to get a consecutive addressing of the CAN nodes in the crate one slot position gets two sequenced identifier addresses. Having in mind that there only 6 identifier bits can be used for addressing, one of the 6 address bits of the crate (BS2..BS0, SL2..SL0) cannot be used. This unused bit is the bank select bit BS0. A module containing two CAN nodes interprets the signals A5..A0 as follows:

The highest address bits A5 and A4 (Signals BS2 and BS1) are directed to the identifier bits ID8 and ID7. The bit A3 (this is the bank select bit BS0) is disregarded. Any problems resulting from this will be discussed in following paragraphs.

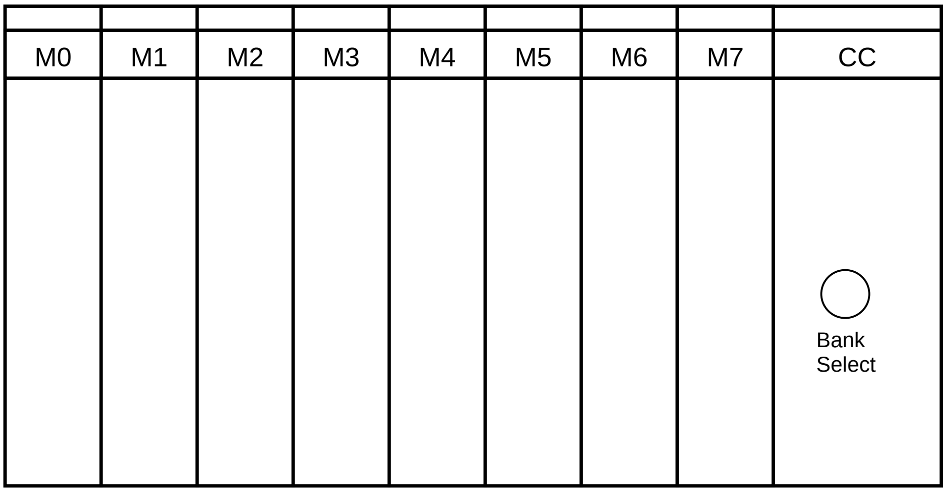
The next three bits A2, A1 and A0 (the slot bits SL2..SL0) are interpreted as the next identifier bits ID6, ID5 and ID4. The last identifier bit ID3 is used to distinguish both the nodes in the module. Node 1 (controlling the lower channels) has ID3=0, node 2 (controlling the upper channels) has ID3=1. The following table gives an overview:

Table 3: Generation of the identifier address bits of a two-node CAN module

	ID10	ID9	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
			A5	A4	A2	A1	A0				
node 1			BS2	BS1	SL2	SL1	SL0	0			
node 2			BS2	BS1	SL2	SL1	SL0	1			

Picture 3 shows the identifiers in a crate which is equipped with “Two-Node” CAN modules. All non-address identifier bits are set like in the example of picture 2. The bank select switch is also set to 2.

Crate (schematic)



module pin									
A0	0	1	0	1	0	1	0	1	fix SL0
A1	0	0	1	1	0	0	1	1	fix SL1
A2	0	0	0	0	1	1	1	1	fix SL2
A3	0	0	0	0	0	0	0	0	set by the switch “Bank Select”
A4	1	1	1	1	1	1	1	1	
A5	0	0	0	0	0	0	0	0	
ID (hex) n 1	**280**	**290**	**2A0**	**2B0**	**2C0**	**2D0**	**2E0**	**2F0**	
ID (hex) n 2	**288**	**298**	**2A8**	**2B8**	**2C8**	**2D8**	**2E8**	**2F8**	

Pict. 3: Identifiers in a crate filled with two-node CAN modules

Detail: Generation of the identifier of the node 1 of module M1

ID10	ID9	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
HVmod	norm	BS2	BS1	SL2	SL1	SL0		res	basic	write.
0	1	0	1	0	0	1	0	0	0	0
2			9				0			

Detail: Generation of the identifier of the node 1 of module M1

ID10	ID9	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
HVmod	norm	BS2	BS1	SL2	SL1	SL0		res	basic	write
0	1	0	1	0	0	1	1	0	0	0
2			9				8			

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

2.1.2 Important Notes I

By mixing " One-Node" CAN modules with " Two-Node" CAN modules in the same CAN segment different rules for ID bits generation have to be followed..

It is not allowed to plug a " One-Node" CAN module directly to the right hand side of a " Two-Node" module.

2.1.3 Important Notes II

In applications with more than one crate and modules with two-CAN-nodes only even bank select numbers (0,2,4,6) are allowed.

By using both types of modules either the one-CAN-node and two-CAN-nodes the " One-Node" modules have to be plugged into the lower slot numbers which is on the left hand side of the crate. The "Two-Node" modules have to be plugged into the right hand side of this.

2.1.4 Algorithm to count the module address

The module address will used in the name space of the "isegHVOPCServer" or the dialog based program "isegCANHVControl". The module address reduce the 11 bit CAN identifier to the graphical position.

y = (mn+1)*sp+mp+cbn

slot position 'sp' of the device (sp = 0..7)
module numbers 'mn' - 1 HV module per device mn=0
- 2 HV modules per device mn=1
module position 'mp' - 0 If the HV module is plugged direct into a crate slot. (single HV modules or the first HV module of a device with 2 HV modules)
- 1 If a second HV module is put on the first module in a double HV module.
crate bank number 'cbn' (If 2 HV modules per device are implemented than even addresses are allowed only.)
cbn = bank select * 8

Example for a double module in slot position 5 and bank select 4:

y = (mn+1)*sp+mp+cbn = (1+1)*5+0+4*8 = 42 -> ma42 first module in the device
(1+1)*5+1+4*8 = 43 -> ma43 second module in the device

2.2 Addressing of the crate controller

In contradiction to the geographic address method of the HV modules the identifier of the crate will be stored inside of this controller. You can change it by the using the implemented software service. Please avoid overlaps if the crate controller is working together in a segment of HV modules.

Note: The crate controller with the lowest serial number will get Sub-ID 0x600 and the Emergency-ID (EMCY-ID) will get 0x400 with the higher priority. The crate controller with the next serial number will get Sub-ID 0x608 and will get the EMCY-ID 0x408. It is working without any problems for segments with a combination of crate controllers and EHQ Multi-Channel HV modules.

Generation of the identifier:

	Sub-ID		EMCY-ID	
ID10	1	crate controller	1	crate controller
ID9	1	normal data transmission	0	alarm
ID8	0	A5 of HV modules	0	A5 of HV modules
ID7	0	A4 of HV modules	0	A4 of HV modules
ID6	0	A3 of HV modules	0	A3 of HV modules
ID5	0	A2 of HV modules	0	A2 of HV modules
ID4	0	A1 of HV modules	0	A1 of HV modules
ID3	0	A0 of HV modules	0	A0 of HV modules
ID2	0		0	
ID1	0		0	
ID0	0		0	
ID (hex)	**600**		**400**	

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