

# **MATELECT SM-HC MODULAR SCANNER SYSTEM**

**SC1, SM1-HC and SM2-HC**  
**For use with DCM-1 and DCM-2**



## **INSTRUCTION MANUAL**

Revision B



**MATELECT****SM-HC SCANNER SYSTEM**TYPE SC1, SM1-HC, AND SM2-HC

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# **MATELECT**

## **SM-HC SCANNER SYSTEM**

TYPE SC1, SM1-HC, and SM2-HC

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These products have been designed to the highest standard in both electronic and mechanical design, with careful attention to stability, reliability and electrical safety.

The scanner system provides a modular way of monitoring multiple specimens or areas of interest and is designed for use in conjunction with the DCM-1 or DCM-2 series of crack growth monitors manufactured by Matelect or indeed as a standalone scanner system. For further details on the DCM-1 or DCM-2 please refer to their respective instruction manuals.

## **IMPORTANT**

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*Please read these instructions carefully before you use the equipment. For your reference please also read our terms and conditions of sale printed at the rear of this manual.*

Please note that there are no user serviceable parts within the scanner system. Never attempt to open an instrument case, unless given express permission to do so by Matelect, as this will void any warranty. Please contact Matelect should you ever experience any difficulties.

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# MAINS OPERATION

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## PLEASE READ BEFORE OPERATION

The SM-HC system is usually powered either by the SC1 scan controller or the DCM-2's inbuilt SC1 scan controller module, however in certain circumstances (when many scanner modules are attached) a separate power supply (the PSU-1) may be employed as an alternative supply source. This is an in-line unit that supplies the required DC voltage for the SM-HC system. It has to be plugged into your local EARTHED mains supply.

Before use, please make sure that the PSU-1 supply rating is correct for the location it will be used in. The PSU-1 must be connected to the mains supply using the fitted mains lead terminated with the appropriate local mains plug.

*The SM-HC instruments are housed in metal cases for strength and electromagnetic screening purposes. To be effective, the enclosures must be connected to mains Earth. This connection is either derived via the DCM-1 unit's AUX power output, the DCM-2's scanner cable OR via the PSU-1. Therefore, if using the PSU-1, PLEASE ENSURE that it is at all times fitted with an Earthed mains connector and that a mains Earth is present at the power socket.*

If the PSU-1 is fitted with a fused mains plug, a 3 Ampere fuse should be used. The PSU-1 is equipped with a short circuit cut-out if the internal regulator is overloaded.

Ensure that the SM-HC system and, in particular, the PSU-1 does not come into contact with fluids or corrosive gases and that the equipment is operated within the temperature range of 0-40 Degrees C.

## OVERVIEW

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The SM-HC multiplexing system was developed to permit the extension of the dual channel Matelect DCPD crack growth monitors, to multiple channel use. Thus an individual DCM-1 or DCM-2 instrument can be used to monitor defect activity in multiple specimen configurations or at multiple sites on a single specimen.

The SM-HC system is modular and can be specified (or expanded) to cover a total of 256 specimen channels. Each module is based on a 4 channel switching unit. Two types of unit exist; the SM1-HC is used for switching the DCPD X and Y signals, whilst the SM2-HC is used to switch the DC excitation current. Both modules are under the control of a single Scan Controller unit, the SC1 or in the case of the DCM-2 a SC1 scan controller module built into the unit..

The Scan Controller can be operated in one of three modes; **MAN**ual, **AUTO**matic or **EXT**ernal. When under **EXT**ernal mode, commands can be sent to the SC1 by a host computer and hence the scanning sequences can be operated under software control. By employing the computer to also log the resultant DCPD data from the crack growth monitor, a complete scan control and logging system can be constructed. To this end, Matelect produce software, which will run on most PC compatibles.

When being used with the DCM-2's built in SC1 module, control is available form a PC, or via the user interface on the DCM-2. (currently under development)

This manual covers the hardware aspects of the SM-HC series scanners. Additional manuals are available to cover Matelect scanner software and our DCPD crack growth monitors, the DCM-1 and DCM-2. For further details, please contact Matelect or your local sales representative. Manuals can also be found on our web site in PDF format for easy download.

Within this manual, text shown in **BOLD CAPITALS** is usually used to indicate lettering that appears on the front/rear panels of the hardware in question.

## GENERAL DESCRIPTION

The component parts of the multiplexing system consist of the SM1-HC Signal switching module, SM2-HC Current switching module and the SC1 Scan Controller or the SC1 scan controller module built into DCM-2's. The SM1-HC contains relays to switch the signals and the SM2-HC contains FETS to switch the currents to and from various specimens, this is done using the SC-1 under **MAN**ual, **AUTO**matic or **EXT**ernal PC control.

The system should be assembled using the diagram below as a guide. The various equipment leads are all illustrated overlaid together with their respective functions.

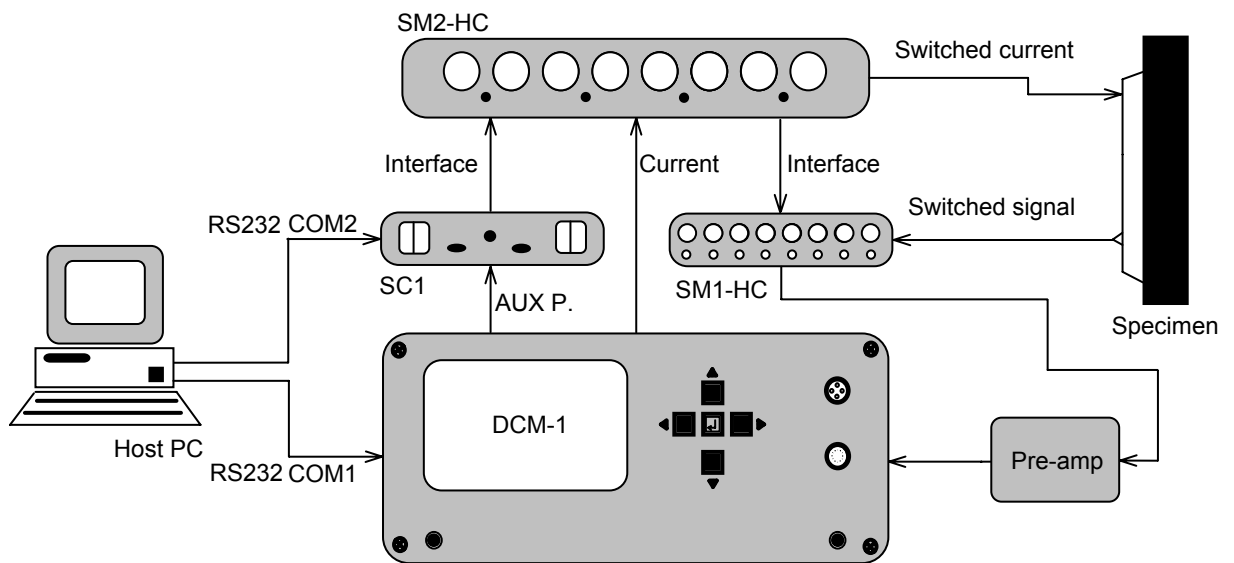


Figure 1. Schematic diagram of the SM-HC multiplexing system with a DCM-1

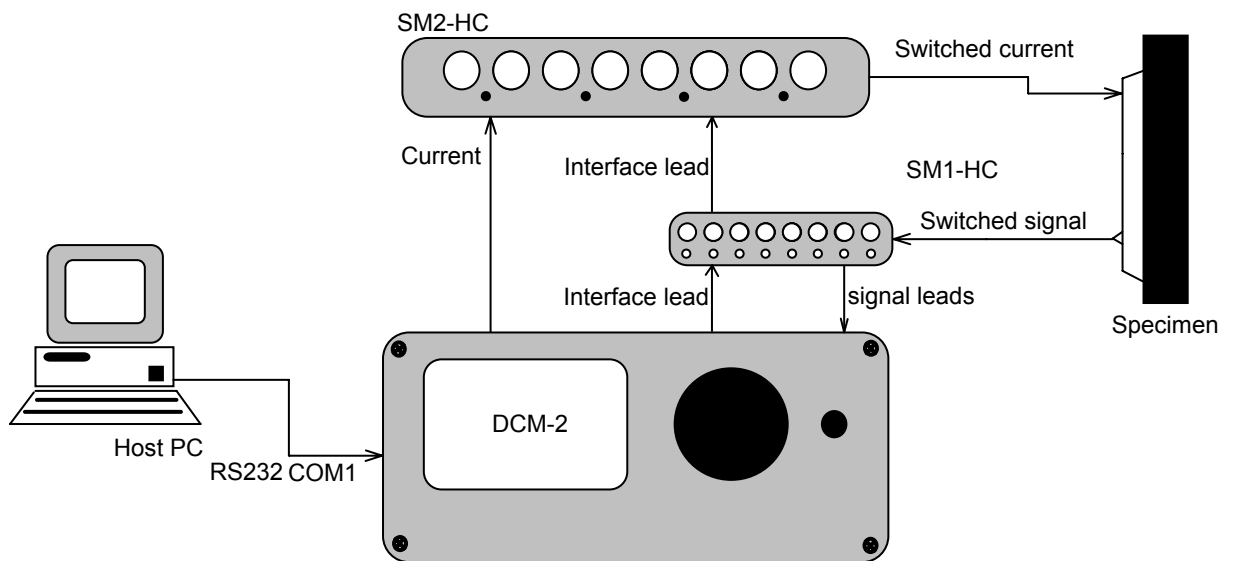


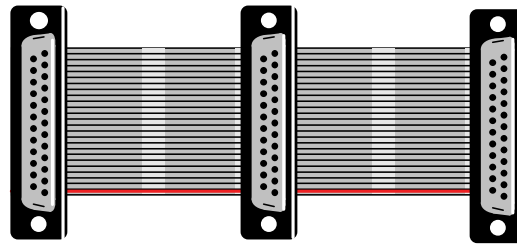
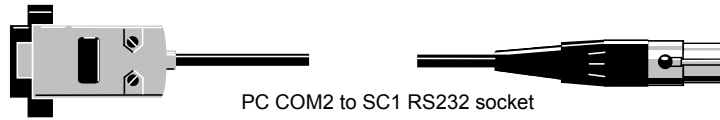
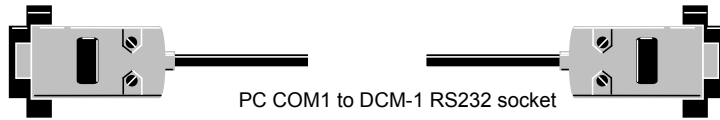
Figure 1a. Schematic diagram of the SM-HC multiplexing system with a DCM-2

The system illustrated on the previous page constitutes the basic 4 channel set-up. Further *SM-HC* units (either current or voltage or both) can be added to expand the system (see the subsection on System Expansion).

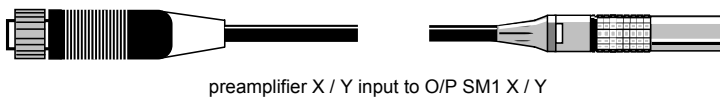
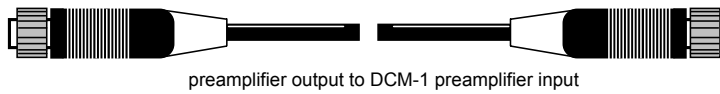
The *SM-HC* system is usually operated in **EXT**ernal mode in conjunction with Matelect scanner software. It is also possible for users to write their own coding to operate the scanners and read data from the DCM-1 instrument. Further information on this topic is also given in the DCM-1 instruction manual.

The two other modes of operation, **AUTO** and **MAN**ual are useful for testing the connections, scanners and signal levels before commencement of the final scanning and logging sequence under **EXT** computer control.





SC1 to SM1 & SM2 daisy chain Interface cable



CGM-5R AUXiliary output to SC1 POWER input

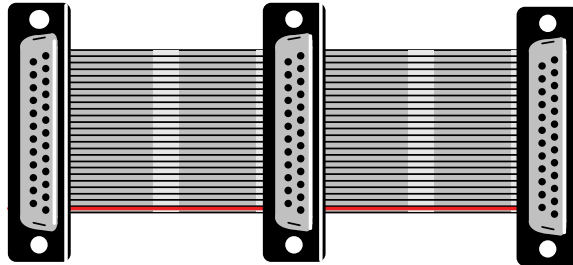


DCM-1 current O/P to SM2 I/P

*Fig 2. Cables supplied with the SM-HC multiplexing system and DCM-1*



**PC COM1 to DCM-2 RS232 socket**



**SM1 & SM2 daisy chain interface cable**



**DCM-2 External I/O socket to SM1/SM2 paralel extension cable.**



**DCM-2 preamplifier module X/Y I/P to SM1 X/Y O/P**



**DCM-2 current O/P to SM2 I/P (2 off, 2-pin and 3-pin)**

*Fig 2. Cables supplied with the SM-HC multiplexing system and DCM-2*

## FRONT PANEL DESCRIPTIONS

The SM1-HC and SM2-HC front panels consist of 8 LEMO type input sockets which act to either deliver the DC excitation current to the specimen or to accept the DC X and Y channel input signals from the specimen.

The current output sockets consist of a large two pin connector for the output current and a large three pin connector for the currents return path. The signal input sockets are small two pin types. A row of red LEDs (for the SM2-HC) or green LEDs (for the SM1-HC) are positioned under the LEMO connector pairs. A lit LED indicates the active channel.

The front panels of the SM1-HC and SM2-HC are shown below in figures 3 and 4.

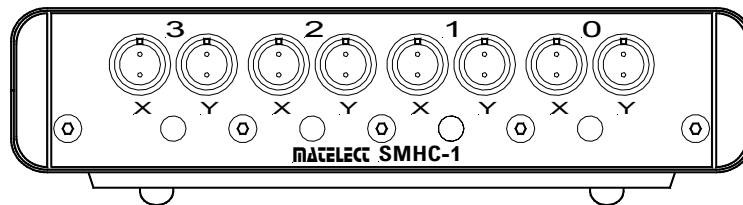


Figure 3. Front panel of SMHC-1

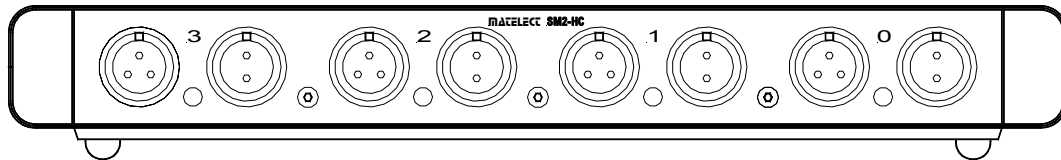


Figure 4. Front panel of SMHC-2

Only the designated LEMO plugs should be used within these input sockets - any other is likely to cause serious damage to these high precision connectors.

Insertion of a plug into a socket is a simple matter of aligning the in-line protrusion on the plug with the corresponding key way within the socket. Once this is correctly done, the plug can be pushed home until it locks in place. To remove the plug, the outer knurled collar should be grasped and pulled perpendicularly away from the front panel. This will simultaneously unlock the plug and effect its withdrawal.

Users should note that very little insertion force is required with the LEMO connectors. If they *have* to be forced, then there is either a miss-alignment or a miss-match of the connectors.

The front panel of the SC1 is shown below in Figure 5.

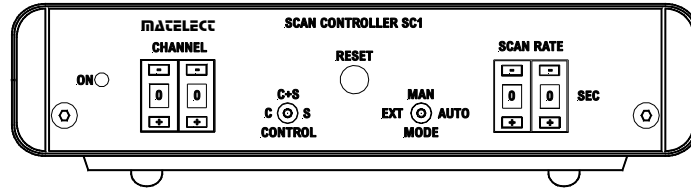


Figure 5. Front panel layout of the SC1 scan controller

### 1. CHANNEL selector

This comprises a two digit switch which can be adjusted to display channel numbers between 00 and 99 by use of the up/down push buttons located above and below each digit. In **AUTO**matic mode, this control allows the user to select the maximum channel number that the scan sequence will reach.

In **MAN**ual mode, the SM-HC modules switch to the channel number selected. The **CHANNEL** selector control is over-riden in **EXT**ernal mode.

*Please note that the first channel in the scanner system is named channel 0. Thus, a four-channel system comprises channels 0 through to 3 inclusive.*

### 2. CONTROL switch

This three position switch is used to select which type of SM-HC module is to be controlled. In the **S** position only the signal scanner (SM1-HC) is activated by the SC1. In the **C** position, only the current module (SM2-HC) is controlled, whilst in the **C+S** position, both types of module are fed control signals.

If a module type is not activated, that module either remains set at channel 0 or the channel that was previously active remains switched in. The **CONTROL** switch is over-riden by the host computer when the SC1 is placed in the **EXT**ernal mode.

### 3. RESET switch

This is a momentary action, push button switch that is used to reset the on-board microprocessor within the SC1. Once pressed, it will reset the microprocessor and return the appropriate SM-HC scanner modules to channel 0. The **RESET** function can be used in all three operational modes, however its use in the **EXT**ernal mode, whilst scanning is being carried out, can lead to software crashes.

#### 4. MODE selector switch

This three position switch is used to set the operational mode of the SC1. The three modes are characterised as follows;

<i>EXTernal mode</i>	<i>Control of SM-HC system by external host PC. All front panel controls (except <b>RESET</b>) disabled.</i>
<i>MANual mode</i>	<i>Allows manual setting of active channel on each SM-HC module via front panel. <b>CHANNEL</b> control switch operable, <b>SCAN RATE</b> switch inoperable.</i>
<i>AUTOmatic mode</i>	<i>Self activated scan sequences enabled. Sequence rises from channel 0 through to channel number selected by <b>CHANNEL</b> switch. The rate of switching between channels is set by the <b>SCAN RATE</b> control.</i>

#### 5. SCAN RATE switch

This control is used to adjust the time delay between successive switch events. The control comprises a two digit BCD switch which can be adjusted to display times (in seconds between 00 and 99, by use of the up/down push buttons located above and below each digit. This control is only applicable to the **AUTO** mode. In the **EXTernal** mode it is overridden by the host PC and in the **MANual** mode it serves no purpose since the channels are accessed manually via the **CHANNEL** selector control.

## REAR PANEL DESCRIPTIONS

Each module is connected to its immediate neighbour by the ribbon cable daisy chain supplied with the system. The chain distributes channel number information, Earth and power lines.

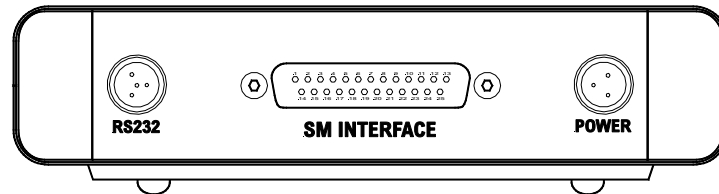


Fig 5. Rear panel view of the SC1 modules

### 1. SC1 RS232 Connector

The host PC to communicate with the SC1 in EXTERNAL mode uses this socket style connector. It is a four *pin* self locking "Switchcraft" type connector and mates with the appropriate Switchcraft plug style connector (*containing 4 sockets*) on the supplied serial lead. This lead is usually terminated in a 9 way D type socket that should be connected to the COM2 serial port of the host PC.

Care should be taken to ensure that the mating plug has its locking tag *correctly aligned* with the keyway in the RS232 socket. If this is the case, then the plug will push home easily.

To remove the plug, finger pressure should be applied to the black unlocking pimple found on the side of the plug so as to release the locking mechanism. The plug can then be removed by pulling it away from the socket.

***Do not attempt to plug the POWER lead into this socket or vice versa - the scan controller and/or the socket can be damaged if this is done.***

### 2. SC1 POWER input connector

This is a three pin, self locking "Switchcraft" type that carries +8V, -8V and Common lines from either the external power supply unit (PSU-1) or the AUXillary output socket of a standard DCM-1.

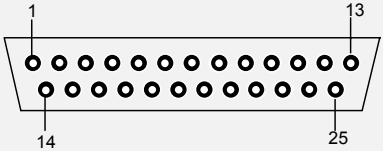
The precautions regarding this connector are outlined in the earlier section on the RS232 socket.

### 3. SC1/SM2-HC/SM1-HC INTERFACE connector

This is a panel mounted 25-way D-type plug (i.e. with pins) and mates with the corresponding D type socket on the daisy chain connector supplied with the system.

In addition to power and information lines, the 25-way connector also has two wires that are used for earth continuity between all the scanner modules connected, which improves EM shielding.

The table below gives the pin functions of the SM-HC interface.



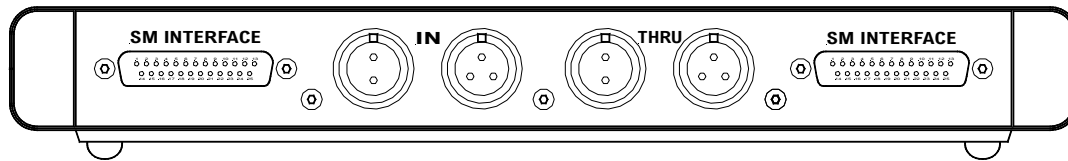
PIN No.	Function
1	Voltage address bit 7 (MSB).
14	Voltage address bit 6
2	Voltage address bit 5
15	Voltage address bit 4
3	Voltage address bit 1
16	Voltage address bit 2
4	Voltage address bit 3
17	Voltage address bit 0 (LSB)
5	Current address bit 1
18	Current address bit 3
6	Current address bit 0 (LSB)
19	Current address bit 2
7	+5 Volt system supply
20	EARTH
8	+5 Volt system supply
21	EARTH
9	Current address bit 5
22	Current address bit 6
10	Current address bit 4
23	Current address bit 7 (MSB)
11	Reserved - do not use
24	Voltage mux. enable (active high logic)
12	Current mux. enable (active high logic)
25	0 volt machine common
13	0 volt machine common

Notes:

1. All logic is active high
2. Logic high level between +3.5 and +5 volts
3. Logic low level between 0 and +0.8 volts
4. Connect current and voltage enables (pins 12 & 13) to system +5 volts for normal operation
5. +5 volt supply must deliver at least 120mA

### DCM-2 SC1 module.

If using the DCM-2 SC1 scanner module simply connect the 25-way daisy chain cable to the parallel extension cable provided, the other end of which should be plugged into the EXTERNAL I/O interface on the rear of the DCM-2 unit and connect the ribbon cable to the other end, in turn connected to the SM1-HF and SM2-HF. The external I/O interface is set up as shown above.



*Figure 5a. Rear panel view of the SM2-HC module*

#### **4. SM2-HC Current I/P's**

This consists of a two pin LEMO plug that is used as the current output connector and a three pin LEMO connector that is used as a current return path. The current is switched by the FETS within the SM2-HC and delivered to the specimen(s) via the SM2-HC front panel connectors.

The two pin LEMO connector mates with the red socket on the DCM-1 or DCM-2 via a short high current lead supplied with the system. Insertion of the socket into the plug is a simple matter of aligning the in-line protrusion on the plug with the corresponding key way within the socket. Once this is correctly done, the socket can be easily pushed home until it locks in place. To remove the socket, the outer knurled collar should be grasped and pulled perpendicularly away from the front panel. This will simultaneously unlock the socket and effect its withdrawal. The DCM-1 end of the cable is simply tightened to the large screw type connector on the back of the DCM-1 unit. If connecting to a DCM-2 simply insert the other end of the lead which will also have a 2-way Lemo plug on it to the rear of the DCM-2. Follow the guidelines given above for the three pin LEMO plug.

If connecting a second SM2-HC to the scanning system simply plug the short 2-way and 3-way cables provided between the first SM2-HC's 'THRU' connectors and the 'IN' connectors of the second SM2-HC.

Users should note that very little insertion force is required with the LEMO connectors. If they have to be forced, then there is either a miss-alignment or a miss-match of the connectors.



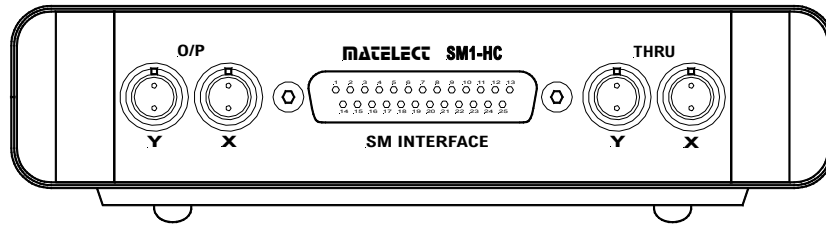


Figure 5b. Rear panel view of the SM1-HC module

## 5. SM1-HC Signal O/P's

These are the panel mounted, LEMO type, **two pin** plugs that are used as the outputs for the switched DCPD signals that are routed into the DCM-1 pre-amp unit or the rear of the DCM-2. The eight signals from the front panel (4 channels, with X and Y values for each) are switched by the relays within the SM1-HC and delivered to the DCM-1 pre-amp unit or DCM-2.

The **O/P** connector of both the X and Y channel mates with the corresponding **two pin** flying sockets on the leads supplied with the system. Insertion of the socket into the plug is a simple matter of aligning the in-line protrusion on the plug with the corresponding key way within the socket. Once this is correctly done, the socket can be easily pushed home until it locks in place. To remove the socket, the outer knurled collar should be grasped and pulled perpendicularly away from the front panel. This will simultaneously unlock the socket and effect its withdrawal. The other ends are connected to their respective sockets on the pre-amp unit or rear of the DCM-2.

If connecting a second SM1-HC to the scanning system simply plug the short 2-way cables provided between the first SM1-HC's X and Y 'THRU' connectors and the X and Y 'O/P' connectors of the second SM1-HC.

Users should note that very little insertion force is required with the LEMO connectors. If they have to be forced, then there is either a miss-alignment or a miss-match of the connectors.

## GENERAL USAGE ADVICE

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### SETTING UP THE SYSTEM

The SM-HC system should be configured as shown in Fig 1 or Fig 1A using the cable list (Fig 2) as a guide. The scanner modules should first be connected to each other using the cables provided and then power should be applied using the DCM-1 AUXiliary output, the DCM-2 scanner lead or the PSU-1 stand alone supply (see below).

If an SC1 scan controller is being used with a DCM-1 then COM1 and COM2 RS232 connections should be made to the host PC. If a DCM-2 is being used then the COM 1 RS232 connection only need be made. Finally the current and voltage umbilicals should be used to complete the connections to the DCM-1 or DCM-2. The equipment can then be switched on.

Connections to the specimen(s) are made using leads terminated in the appropriate LEMO plugs. Matelect can supply stock cable sets (CABL1-HC and CABL2-HC) or manufacture cables to order.

It is important to remember that, when fabricating cables, attention should be paid to minimising the overall length of the cable. In the case of the voltage leads, this helps to reduce EM pick-up and in the case of the current leads, it maximises the available current to the specimen by minimising its resistance.

*Users should note that they should never have to force a connector either into or out of its mating socket - undue force implies a miss-alignment of these components and can lead to degradation of the electrical contacts.*

### POWER SUPPLIES

The scanner system is normally powered from the AUX. supply output of a DCM-1 monitor or the scanner lead of the DCM-2.

The AUX. supply from the DCM-1 monitor or the DCM-2 scanner lead is normally used to power a maximum of 2 voltage and 2 signal scanner modules, plus a scan controller. If it is desirable to extend the system beyond this number of modules, then the separate PSU-1 or an alternative, suitably rated power supply unit, must be used.

If the equipment is already powered by an external PSU then users should check with Matelect, before ordering further scanner modules, that the PSU is capable of handling the power requirements.

## USING THE MODES (SC1 scan controller)

Once the system has been set up and the specimen connected in, the signal levels present at the specimen can be checked individually using the **MAN**ual mode of the SC1 to step through each channel in turn. Adjustments to the wiring and the DCM-1 or DCM-2 controls can then be made in order to optimise the signal levels - before formal testing begins.

It *is* possible to operate the SM-HC system without an external computer if none is available. The system then needs to operate in the **AUTO**matic mode, and some means of data logging (e.g. via a chart recorder) has to be employed to record the DCM-1 analogue output.

Unlike a computer program, which can both switch to a channel and record its activity, the above method does not associate the recorded data with a particular channel number and could therefore lead to confused results. It should be avoided if possible.

### Important!

You are highly recommended to only switch current channels when the current is OFF, failure to do so may result in damage to the SM2-HC due to very large current spikes. For this reason you are advised to use Matelect software which takes this into account.

## SOFTWARE (DCM-1)

Dedicated software for the logging of DCPD data and the control of the multiplexing system is available from Matelect. Please contact Matelect concerning DCM-2 software.

DCMpeek4 is a 4 channel package that performs the logging and scanning functions whilst simultaneously displaying the activity on each channel as a graph of potential drop against time.

The package is a 32-bit windows based application and can be run on any Microsoft Windows compatible PC.

For users who wish to write software, Matelect can provide details of protocols etc. In **EXT**ernal mode, the SC1 accepts the following ASCII codes from a host computer;

<i>SX+LF+CR</i>	<i>Where S refers to "Signal" (i.e. SM1-HC modules)</i>
<i>CX+LF+CR</i>	<i>Where C refers to "Current" (i.e. SM2-HC modules)</i>
<i>MX+LF+CR</i>	<i>This will set both signal and current concurrently</i>
	<i>Where X refers to the channel number 0 to 255 inc.</i>

Thus sending S4 and C2 in sequence, to the SC1, will instruct it to switch the *SM1-HC* to channel 4 and the *SM2-HC* to channel 2.

## MODULE ADDRESSES

Each *SM-HC* module has an address with which it is accessed by the SC1 scan controller or scan controller module built into the DCM-2. The addresses are factory set before shipment and determine whether the module is designated as containing Channels 0 to 3, 4 to 7 etc. The modules are labelled on their underside with this designation.

It is important, therefore, when expanding the system by purchasing further modules to specify the required channel designation. Alternatively this can be changed by adjusting the address which is set by a PCB mounted 6 way binary coded DIL switch located within each module. This is done according to the following table;

Channel designation	DIL setting
0-3	000000*
4-7	000001
8-11	000010

(\*The left most bit is the least significant)

Please contact Matelect before attempting to do this for warranty reasons.

Therefore, although **MAN**ual setting of the channel can only extend to channel 99, the **EXT**ernal maximum is 256 channels (11111 corresponds to channels 248- 255).

## SYSTEM EXPANSION

The *SM-HC* multiplexing system can easily be expanded to accommodate further signal and current channels. A theoretical maximum of 256 channels can be handled by the SC1 scan controller (256 signal + 256 current).

However, in practice, the method of connection of the modules to each other limits a *practical* system to 24 channels of each type. Therefore, if there is an intention to operate beyond this practical limit, Matelect will recommend a self contained, rather than a modular, approach. Further information can be obtained from our head office.

Expansion of an 4 channel system to 8 channel will require *one* additional module of each type (assuming both current and signal are to be multiplexed) plus a revised daisy chain **INTERFACE** link.

Users who are unsure about their expansion requirements should contact Matelect at our head office for further advice and information.

## BRIEF SPECIFICATIONS:

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### SC1

Type: Microprocessor based (8031) controller unit (**SC1 only**)  
 Clock speed: 12MHz (**SC1 only**)  
 Modes: EXTERNAL (PC), MANUAL and AUTOMATIC  
 Capability: 256 channels in EXTERNAL mode, 99 in MAN & AUTO  
 Power: +/-5 volts DC @ 300mA  
 Controls: Channel delay to 99 seconds, manual channel select to chan.99  
 Comms: Serial RS232, 300 Baud, 8 data, no parity bits  
 Case: Epoxy coated steel enclosure to IP20

### SC1 Module

Type: DCM-2 hosted control  
 Modes: 256 channels in EXTERNAL mode, MAN & AUTO T.B.A.  
 For all other parameters refer to the DCM-2 manual.

### SM1-HC

Type: 4 channel DCPD voltage signal switching module  
 Addresses: 000000 to 111111  
 Set via: Internal 6 way DIL switch  
 Relays: Pickering type double pole changeover dry reed  
 Rating: 0.5A max at 20V, 0.05A at 200V max  
 Contacts: Rhodium plate  
 Power: +/- 5 volts from SC1  
 Input: 2 pin LEMO type X 8  
 (mates with FGG0B302CNAD42Z LEMO plug)  
 Output: 2 pin LEMO to 8 pin DCM-1 input  
 Case: Epoxy coated steel enclosure to IP20

### SM2-HC

Type: 4 channel DCPD current switching module  
 Addresses: N/A  
 Set via: N/A  
 Rating: 50A @ 1/3 duty cycle, max on time 350ms at 6v  
 Power: +/- 8 volts from SC1  
 Output: 3 pin LEMO & 2 pin LEMO  
 Input: 3 pin LEMO to spade connector of DCM-1 output RED  
 2 pin LEMO to spade connector of DCM-1 output BLACK  
 Case: Epoxy coated steel enclosure to IP20

### PSU-1

Type: Stand alone power supply unit  
 Input: 230V AC 50/60Hz OR 110V AC 50/60Hz  
 Output: +/- 8 Volts @ 300mA Regulated  
 Fuse: Internal short circuit protection and 3A fuse (UK plug)

All modules are built to the CE/IEC 1010 standard for electrical safety



## **WARRANTY AND SERVICE INFORMATION**

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**The following text is an extract from our standard conditions of sale. It covers the terms of warranty and liability only. Please refer to the full text, supplied upon delivery of the goods or contact Matelect Limited.**

### Extract 6. WARRANTY

Items sold by the company are warranted only as stated below.

Subject to the exceptions and upon the conditions specified below, the company agrees to correct, whether by repair or, at its election, by replacement, any defect of materials or workmanship which develops within twelve months after delivery of the instrument to its original purchaser by the company or by any authorised representative provided that investigation and factory inspection by the company discloses that such defect developed under normal and proper use (unless covered by a separate agreement or guarantee written by the company).

The exceptions and conditions mentioned above are the following.

- a). The company makes no warranty concerning components and accessories not manufactured by it. however, in the event of the failure of such components or accessory, the company will give reasonable assistance to the purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in the light of the manufacturer's own warranty.
- b). The company shall be released from all obligations under its warranty in the event of repairs or modifications being made by persons other than its own or authorised service personnel unless such repairs by others are made with the written consent of the company or unless such repairs are minor or merely the installation of a new Matelect component.
- c). The warranty is only valid providing that the terms of payment in clause 4 are strictly adhered to.
- d). No product may be returned except with the company's permission in writing. After receiving factory authorisation, goods requiring repair or replacement should be sent prepaid to the factory in the original container properly packed accompanied by a Return Goods Authorisation, purchase order or letter stating as completely as possible the defects and the condition under which it occurred.

### Extract 8. CONDITIONS PARAMOUNT

The company expressly disclaims any liability of whatsoever nature and in any circumstances whatsoever, to its customers, dealers or agents, except as stated in the forgoing terms and conditions.

Extract 9. These terms and conditions of sale may be amended or altered at any time the company feel it necessary to do so.

### ***REPAIR AND RECALIBRATION:***

Matelect Limited can repair and/or recalibrate instruments manufactured by it, after the warranty period has expired. If this service is required then please contact Matelect and we will be pleased to provide a quotation for the work necessary.