USERS HARDWARE REFERENCE MANUAL

ENG -OM-001-01

Version 01

FOR AUTOMEG MODELS

Model 1000

Model 1500

Model 2500

Model 3500

Model 5000

Model 8000

MKAT SOFTWARE VERSION

MODIFICATIONS

Issue	Date	Modified by	Observations
01	12/05/2025	DSM	Update manual to include references to MKAT software.

Table of Contents

Table of Contents

1 Introduction and Safety

This manual is designed to give an insight into the AutoMeg hardware and associated components and aid in any simple system fault analysis.

The manual is not designed as a service manual. There are no user serviceable parts inside the equipment.

For complete service details, the AutoMeg service manual is available in conjunction with a training course normally held at the customer's premises.

Please contact MK Test Systems Ltd sales department for more information about service training courses.

AC power supply voltages and other high voltages are present within the equipment.

WARNING!

HAZARDOUS VOLTAGE. ELECTRIC SHOCK RISK.

NO USER SERVICEABLE PARTS INSIDE THE EQUIPMENT

CONTACT MK TEST SYSTEMS LTD FOR SERVICE OR REPAIR

2 Operator Responsibility

The AutoMeg test system is designed to ensure safe operation when installed, operated, and maintained according to common safety regulations. This section explains the potential dangers that may arise when operating the equipment and specifies the most important safety precautions to preclude these dangers as far as possible.

- The operator is responsible for the qualification of the personnel operating the equipment.
- The personnel operating the equipment should be regularly instructed about the dangers involved with their job activities as well as measures to avert these dangers including the risk of electric shock.
- Make sure all persons tasked with operating, installing, and maintaining the equipment have read and understand the safety information and operating instructions.
- If you have any questions concerning the operation of the equipment, please contact us:

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Home page:

Support:

3 Abbreviations used in this manual

The following abbreviations are used in this manual:

MKAT	MK Automated Tester (Software)
UUT	Unit under test
HV	High Voltage
LV	Low Voltage
EM	Energisation Module – provides switchable energisation points.
DW	Dual Wire measurement (for both 2 and 4 wire continuity testing)
4W	4 Wire measurement (for continuity testing)
2W	2 Wire measurement (for continuity testing)
MBUS	Multi-bus. Provides additional 2 (bus) connections to any test point.
MDU	AC power supply (Mains) Distribution Unit

4 Safety Instructions

4.1 Description of symbols used in this manual

Instruction manual symbol. Equipment will be marked with this symbol when it is necessary to refer to the user manual.

Describes a dangerous situation. If these instructions are not followed severe injury and danger to life could result.

CAUTION Risk of Electrical Shock

Helpful information and tips

4.2 Operating Environmental Conditions

The AutoMeg test system safety approval applies to the following operating conditions according to IEC 61010-1:

- Indoor use only – IP20
- Ambient temperature +5°C …40°C
- Humidity: Max RH 80% non-condensing for temperatures up to 31°C, linear decrease down to 50% at 40°C
- Altitude: up to 2000m – normal zero

- Dust-free
- Away from direct sunlight

4.3 Storage Environmental Conditions

When the test system is not in use, we recommend the following storage conditions:

- Indoor use only – IP20
- Ambient temperature +0°C …45°C
- Humidity: Max RH 85% non-condensing
- Altitude: up to 2000m – normal zero
- Dust-free
- Away from direct sunlight
- Protect from potential water damage
- Avoid stacking heavy items on top of equipment

4.4 Re-commissioning of equipment after storage

If the system is stored for a period of greater than 3 months, we recommend the system goes through a basic re-commissioning process before use. This process should include a minimum power up period of 15 minutes followed by a full system self-test. A system HV Insulation Resistance test should also be performed for all test points where applicable.

4.5 Environment - Cooling

Make sure all equipment vents are cleared of any obstructions to enable air to circulate and keep the equipment cool.

4.6 Earthing - Safety Ground

This equipment is a Safety Class 1 instrument. To minimise shock hazard, the equipment chassis must be connected to an electrical (safety) earth. The equipment must be connected to the AC power supply through a 3-conductor power cable for Single Phase supply or 5 conductor power cable for Three Phase supply with the electrical (safety) ground connected at the power outlet.

4.7 AC Power Supply Requirements

The equipment AC power supply voltage and power requirements are stated on the system machine plate.

The AC power supply range is as follows:

Rated supply	Type	Voltage range	Rated frequency	Frequency range
115V	~	103 – 127Vac	60Hz	55 – 65Hz
230V	~	206 – 254Vac	50Hz	45 – 55Hz
400V	3~	360 – 440Vac	50Hz	45 – 55Hz

Ensure the AC power supply is suitable for the equipment power rating, which is stated on the equipment machine plate.

4.8 Sound Levels

Typically, less than 85dba at 1 metre.

5 Equipment Installation

The MK Test System is available in either bench mounted cabinet, floor standing cabinet, or mobile cabinet. Upon unpacking the MK Test System, inspect for damage which may have occurred in transit. Inspection should confirm there is no exterior damage.

Refer to overview drawing and data sheet for specific system information.

5.1 Equipment Handling

- NOTE: The AutoMeg equipment and associated ancillaries can be heavy.
- Standard 6U cabinets are a two-man lift with built-in lifting handles along each side.
- Use forklift guides and lifting eyes when fitted.

- Observe all health and safety precautions when lifting heavy equipment.

5.2 Equipment Safety

- This equipment must only be operated by trained personnel.
- There are no user serviceable parts inside this equipment.
- Repairs or Service only to be undertaken by qualified personnel.
- This equipment should be tested for electrical safety (PAT) annually.

- **This equipment must be earthed**. Only connect the equipment to an AC power socket with an earthing contact (PE- protective earth). Where fitted use earth terminals (studs) to provide additional equipment earth.
- The AC power supply plug serves as a safe disconnecting device from the AC supply and must always be easily accessible.
- Ensure the AC supply is fitted with a suitably rated fuse or circuit breaker device.
- The installation of a 30mA earth leakage safety device in the AC supply is recommend.
- Ensure AC supply connectors and cords are not damaged before use. Where fitted ensure isolators, and safety devices are easily accessible.
- Never remove warning labels.
- Never override safety devices.
- Where fitted, regularly test safety devices.
- Ensure all ventilation panels and fans (where fitted) are clear.
- Always ensure floor mounted systems are on a level, even surface. Ensure bench mounted systems are on a level, even surface, of suitable construction.

- Where fitted, ensure castor brakes are applied before using the equipment.
- Repairs or service only to be carried out by qualified personnel.

The safety of any system incorporating the MK Test System is the responsibility of the system installer.

5.3 Safe Operating Environment

This equipment must be is operated in safe working area to minimise risk of electric shock especially when performing high voltage tests.

- Create a secure working area – use physical barriers around all test equipment, interface cables and UUT (unit under test)
- Ensure isolation devices are accessible – including AC power connector / supply isolator.
- Ensure working area is well lit and ventilated.
- Warn others of electric shock risk – use warning signage, beacons etc.
- Keep area clear of obstructions and trip/ slip hazards e.g., cables.
- Avoid operating in an ESD area and when wearing ESD protective clothing.

Consider using safety devices to protect area. e.g., light curtains/barriers

Use emergency-stops in area to isolate the AC supply in an emergency.

Know what to do in an emergency. Use Electric Shock - First Aid posters in area. Provide first aid training for operators.

Provide risk assessment and method statement for the test area.

5.4 Safe Operation

- Only to be used by trained operators.
- Regularly test all safety devices – before testing.
- Do not work alone. Ensure at least two people are in the area when testing.
- Alert and inform others before testing.

- **Never touch interface cables, connectors, or UUT during testing.**
- **Wait at least 1 minute** after testing has completed before touching interface cables connectors, or UUT. This is to allow time for possible stored energy to be discharged safely. Note: This time may have to be increased when testing a UUT with very capacitive circuits.

5.5 Electrical Safety features – Internal energy sources

The MK Test System uses both internal low voltage & high voltage sources to perform electrical testing. These are designed to minimise electric shock risk to the operator and others by restricting the maximum output energy level as shown in table below:

MK Test System - Internal Sources (Stimulus)

Model	Source or Stimulus	Absolute Maximum Voltage*	Absolute Maximum Current *
1500	Low Voltage (LV)	40Vdc	2Adc
	High Voltage (HV) DC	1550Vdc	5mA
	High Voltage (HV) AC	1050Vac (50Hz or 60Hz)	5mA
2500	Low Voltage (LV)	40Vdc	2Adc
	High Voltage (HV) DC	2550Vdc	5mA
	High Voltage (HV) AC	1550Vac (50Hz or 60Hz)	Depending on option
5000	Low Voltage (LV)	40Vdc	2Adc

	High Voltage (HV) DC	5050Vdc	5mA
	High Voltage (HV) AC	3550Vac (50Hz or 60Hz)	Depending on option
8000	Low Voltage (LV)	40Vdc	2Adc
	High Voltage (HV) DC	8100Vdc	Depending on option
	High Voltage (HV) AC	5500Vac (50Hz or 60Hz)	Depending on option

*The above values may differ depending on the system model variants

5.6 HV Dump Circuit

The MK Test System uses a high voltage dump circuit to discharge energy in the system, interface cabling and UUT due to charged energy at the end of each HV test. The HV dump hold time is dynamic and will depend on how long it takes to discharge the energy to a safe level.

The default maximum hold time is set to 1 second, which in certain applications may not be sufficient to completely discharge the energy in both UUT and interface circuits to a safe level. Therefore, it is the responsibility of the end user to check the HV hold time and take any other precautions necessary to ensure user safety.

This is particularly important when performing high voltage AC/DC tests (IR or Hi-pot) on a UUT with very capacitive circuits. The UUT capacitance increases when the surface area between conductors and insulation becomes large resulting in increased stored energy at the end of the test. For example, when testing cables with increased length or large cross-sectional area.

The UUT capacitance may also increase when performing high voltage group tests (either by physical connection or via test program) where small capacitances are connected in parallel to create a higher capacitance.

We recommend, extra precautions should be taken where stored energy presents a risk of electric shock. Precautions may include:

- Add delay time within test programs after each high voltage test.
- Place the UUT behind physical interlocked barrier or in a cage.
- Consider use of a discharge rod/ system.

5.7 Interlock Circuit

The MK Test System is fitted with an interlock circuit which is connected to the front panel auxiliary socket – see Auxiliary Connections. When the interlock circuit is “broken” the internal power to all HV sources is isolated and the HV dump circuit (above) is activated.

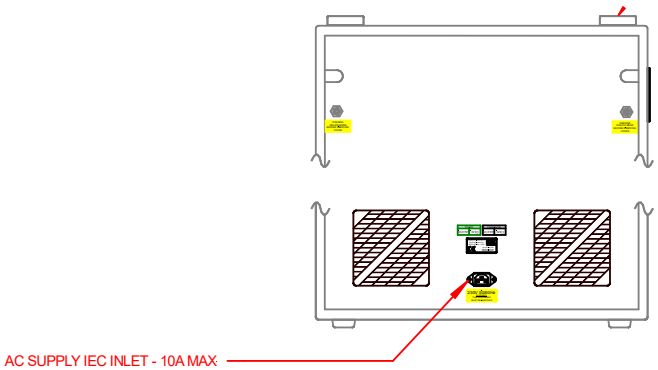
6 System Overview

6.1 AC Supply Distribution

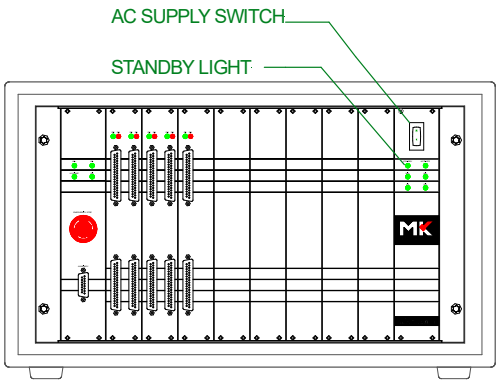
The internal distribution of the AC supply varies depending on the system configuration. Refer to the system overview drawing for the configuration used.

Small AutoMeg systems normally have simple AC distribution consisting of an IEC inlet filter assembly, usually fitted to the rear panel which is connects to each internal AC powered equipment within the cabinet.

AC Supply IEC Inlet Option



Front Panel AC Supply Switch (on main Subrack)



All AutoMeg systems have a main sub-rack with **an AC Supply Switch** fitted. This must be switched in the ON or 1 position to allow the AC supply to connect. This is confirmed when the **Standby Light** is ON.

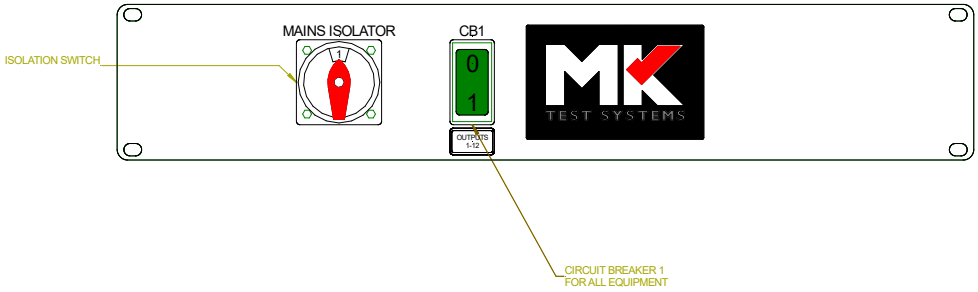
For larger AutoMeg systems, a power (AC) Mains Distribution Unit (MDU) is normally fitted. All MDU's provide AC supply isolation via an isolation switch and EMC filtering. Internal AC powered equipment is connected to MDU's via rear panel mounted IEC C13 sockets.

These are available in the following options:

AC Power Supply (Mains) Distribution Unit with single circuit breaker. Part No: AM4-0941-01-GA

This type of MDU is designed for an AC supply in the range 103Vac to 254Vac (50/60Hz) and only has one output circuit which is protected by CB1. There are 12 off IEC C13 sockets numbered 1 to 12 on the rear panel, all connected to the AC supply via CB1 which is rated at 10A.

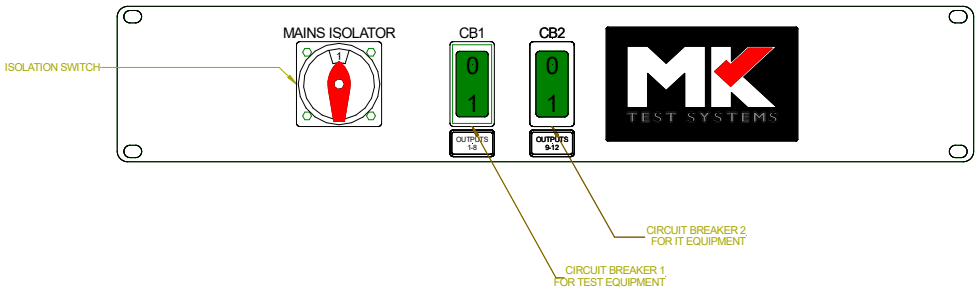
MDU Part No: AM4-0941-01



AC Power Supply (Mains) Distribution Unit with two circuit breakers. Part No: AM4-0941-02-GA

This type of MDU is designed for an AC supply in the range 103Vac to 254Vac (50/60Hz) and has two separate output circuits which are protected by CB1 & CB2. There are 12 off IEC C13 sockets on the rear panel numbered 1 to 12. IEC C13 sockets numbered 1 to 8 are connected to CB1 which is rated at 10A. IEC sockets numbered 9 to 12 are connected to CB2 which is rated at 10A. Typically, this option MDU is used to separate AC powered IT equipment from AC powered test equipment.

MDU Part No: AM4-0941-02



AC Power Supply (Mains) Distribution Unit with Safety System – Part No: AM4-0941-05

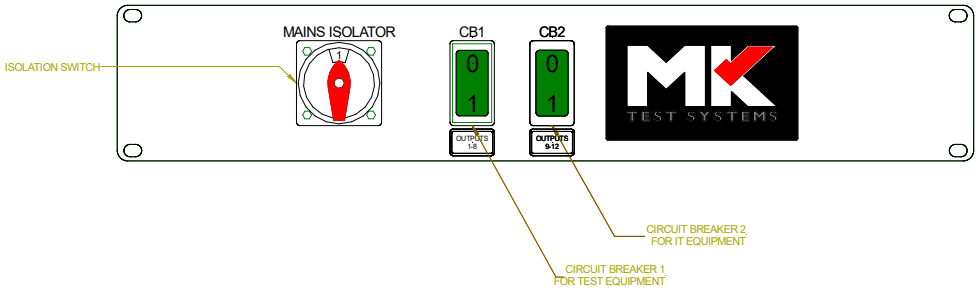
This type of MDU is designed for an AC supply in the range 103Vac to 254Vac (50/60Hz) and has an output circuit protected via a safety circuit and CB1 which is rated at 10A. The safety circuit is operated via a two - channel normal closed loop circuit which may be connected to various internal and external safety devices e.g., emergency stop buttons. When the safety circuit is operated, all AC equipment connected to rear panel IEC C13 sockets numbered 1 to 8 are disconnected from the AC supply. AC powered equipment requiring permanent AC power i.e., IT equipment is connected to rear panel IEC C13 sockets numbered 9 to 12 and protect via CB2 which is rated at 10A.

The safety circuit may be configured internally as either **automatic** or **manual** reset using a green START button depending on system requirements.

In **automatic** reset configuration, AC power will be restored after operation when both Channel 1 & Channel 2 are closed and both channels are isolated from one another. AC power will be isolated if either Channel 1 or Channel 2 become open or both Channels are shorted together. Also, in automatic reset configuration if the safety circuit power is OK and AC supply is switched off, and power will be automatically restored when AC supply is restored.

In **manual** reset configuration, AC power may only be restored after operation when the two channel normally closed loop circuit connections (see above) are restored and the equipment green START button is pushed by the operator. Also, in manual reset configuration, if the safety circuit is OK and AC supply is switched off or interrupted, power will not be automatically restored when the AC supply is restored. In this scenario the green START button fitted must be pushed to restore AC power i.e., no-volt protection.

MDU Part No: AM4-0941-05



A red STOP button may also be fitted to the equipment to isolate AC power to the safety circuit equipment with this type of MDU configured in either automatic or manual reset mode.

This type of MDU has an 8 way Mini-Fit Junior Socket to allow connection of the external safety devices as follows:

MDU AM4-0941-05-GA – Rear panel Molex MFJ connector pin outs		
Pin	Function	Connection
1	E Stop / Interlock Channel 1 a	Connect to Normally closed-circuit.

2	E Stop / Interlock Channel 1 b	(Channel 1)
3	E Stop/ Interlock Channel 2 a	Connect to Normally closed-circuit. (Channel 2)
4	E Stop/ Interlock Channel 2 b	
5	Start a	Automatic Reset: Link pins 5 & 6 Manual Reset: Connect momentary normally green START button
6	Start b	
7	Aux Out System ON a	When safety system OK pins 7 & 8 connected. When safety system NOK pins 7 & 8 open circuit
8	Aux Out System ON b	

Connection of external safety devices

When an MDU with a safety system is installed in the test system, a connector to allow connection of external safety devices is also normally fitted. A mating-half terminator plug is supplied for connection of external safety devices but must be fitted allowed the safety system AC equipment to be powered. There are two main connector types used for connection external safety devices as follows:

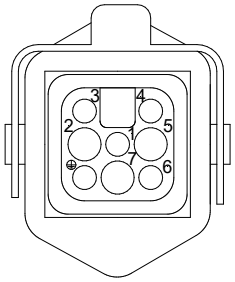
Harting ® HAN 3A connector /terminator. Part No:

This type of connector is normally fitted when the system is not distributed and does not have satellite cabinets connected via an umbilical cable i.e., system installed in one cabinet. This connector is wired as follows:

Harting HAN 3A connector pin out		
Pin	Function	Connection
1	E Stop / Interlock Channel 1 a	Connect to Normally closed-circuit. (Channel 1)
2	E Stop / Interlock Channel 1 b	
3	E Stop/ Interlock Channel 2 a	Connect to Normally closed-circuit. (Channel 2)
4	E Stop / Interlock Channel 2 b	
5	n/a	Do not connect
6	n/a	Do not connect
7	n/a	Do not connect

E	Earth (not connected)	Do not connect

Harting HAN 3A Interlock Connector



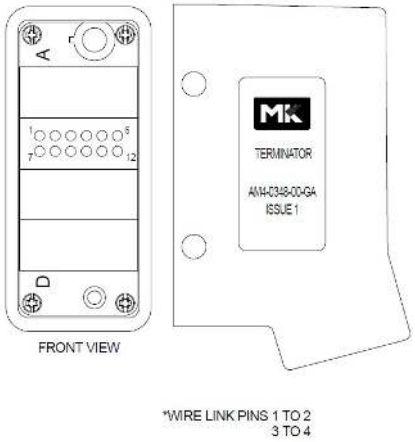
Umbilical HAN Modular Terminator. Part No: AM4-0348

For distributed systems, umbilical cables are used to connect the main cabinet (console) to all satellite cabinets in the system. These are connected to umbilical IN and OUT connectors on each cabinet. The umbilical connectors have dedicated pins for measurement bus, relay addressing, warning beacon, and safety system. In the last OUT connector of the “chain” an HAN Modular terminator must be fitted. The terminator allows the user to connect external safety devices as follows:

Harting Modular Terminator (insert position B)		
Pin	Function	Connection
1	E Stop / Interlock Channel 1 a	Connect to Normally closed-circuit. (Channel 1)
2	E Stop / Interlock Channel 1 b	
3	E Stop/ Interlock Channel 2 a	Connect to Normally closed-circuit. (Channel 2)
4	E Stop / Interlock Channel 2 b	
5	Start a	Automatic Reset: Link pins 5 & 6
6	Start b	Manual Reset: Connect momentary normally green START button

Pins 7 to 12 are dedicated to functions not associated with the MDU safety system.

HAN Modular Terminator. AM4-0348



If no external devices are connected a loopback plug (supplied) must be fitted in the interlock socket to allow the safety circuit to operate normally.

6.2 Computer and Control System

The computer controls the AutoMeg and provides an interface to the operator or programmer via screen displays and printed /archived reports. It also allows the operator to input data via the keyboard, bar code reader or touch screen.

MK Test Systems Ltd normally provide the computer and monitor with the AutoMeg system. If this not the case, then refer to the relevant product data sheet for minimum IT equipment specifications.

The computer may be external, or rack mounted inside the system cabinet.

6.3 Communication Card – PCI or PCIe

The computer is fitted with a communication (or PCI -PCIe) card which provides control signals to and from (I/O) the control board inside the AutoMeg cabinet via control cable.

Note: in rack mounted computers the control cable may be a flat ribbon cable which is connected inside the computer case.

6.4 Control Cable – for external computers

The control cable AM4-0261 connects an external computer to the AutoMeg test system. The cable is fitted with a 50Way D connector at each end. Ensure both ends of the cable are connected correctly and tighten all screw locks to secure.

6.5 AutoMeg System

The AutoMeg unit itself is fully contained but can vary from unit to unit depending on the system configuration. Refer to overview drawing and/ or manual supplement for details.

7 Starting Up

7.1 Start-up Procedure

- Ensure AC power supply is connected, and if fitted, ensure MDU is powered OK, see AC Supply Distribution.
- Switch on the computer by pressing the start button. Ensure the  itor is on standby.
- Switch on the AutoMeg system using the front panel switch and ensure the “Standby” indicator (on the right-hand panel) is ON. If not check the AC power supply is connected.
- Open the MKAT Runner applica  on the desktop.
- Log into the MKAT Runner Software – see MKAT software manual for log in details.
- Once successfully logged in, the AutoMeg should switch on with all indicator lights ON - except HV DUMP.
- If the MKAT software is not installed, then follow the installation procedure in the MKAT software manual.
- The MKAT software screen should acknowledge that the system is switched on.
- The system is now ready to operate. However, to achieve optimum performance the system should powered up for a minimum of 10 minutes prior to running tests.

7.2 Shut-down Procedure

- Exit the MKAT Runner software.
- Ensure all indicators are OFF except the “Standby” indicator.
- Switch off the AutoMeg system using the front panel switch and ensure the “Standby” indicator (on the right-hand panel) is OFF.
- Shut down the computer. Disconnect the AC power supply.

7.3 Restart after Interlock or E-Stop Procedure

- The MKAT Runner Software will show “AutoMeg Not Switched ON”.
- Investigate why the interlock or e-stop was activated. Ensure the complete system including external devices etc is safe before restarting the system
- Re-make interlock circuit or twist e-stop clockwise to reset.
- Push the Green Start button. Power should be restored and MKAT Runner message cleared.

8 Relay Boards

All MK Test systems require relay (switching) boards to provide user test points. The relay boards are fitted in the MK Test system sub-racks connecting via the motherboard to the internal MK measurement BUS. Depending on configuration, additional Multi BUS (BUS) may also be connected.

All relay boards are powered via the motherboard and this is indicated by Green LED on the front panel. A Red LED on the front panel indicates if the relay board is being Enabled or switched.

All relay boards create test points by connecting a connector pin on the front panel to the measurement BUS (and MBUS for MBUS boards) via relays mounted on the board.

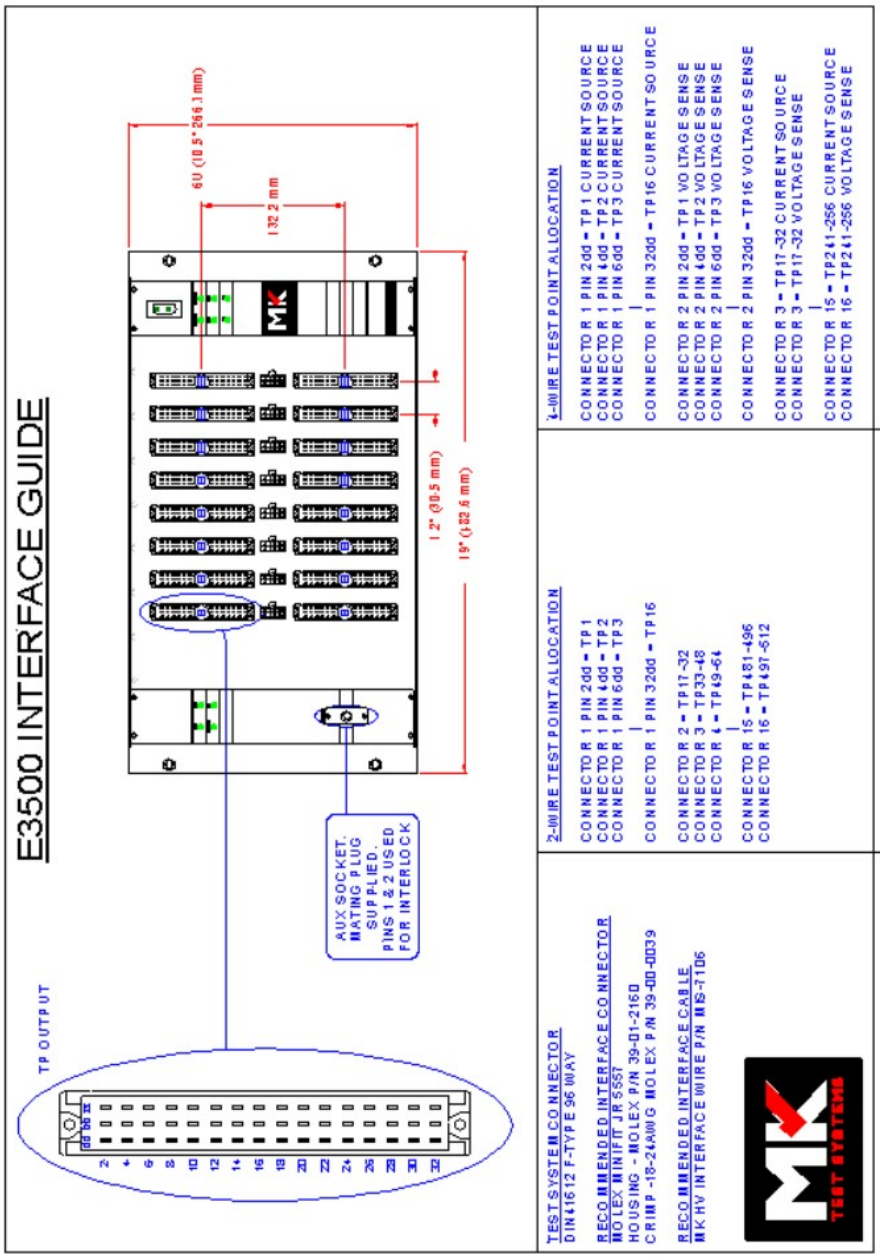
The relay board type determines the following:

- Number of test points
- Maximum high voltage DC & AC rating of test points
- Test point configuration – 2 wire, 4 wire, Dual wire, or MBUS (Multibus)

9 Model 3500, 5000 & 8000 interfaces

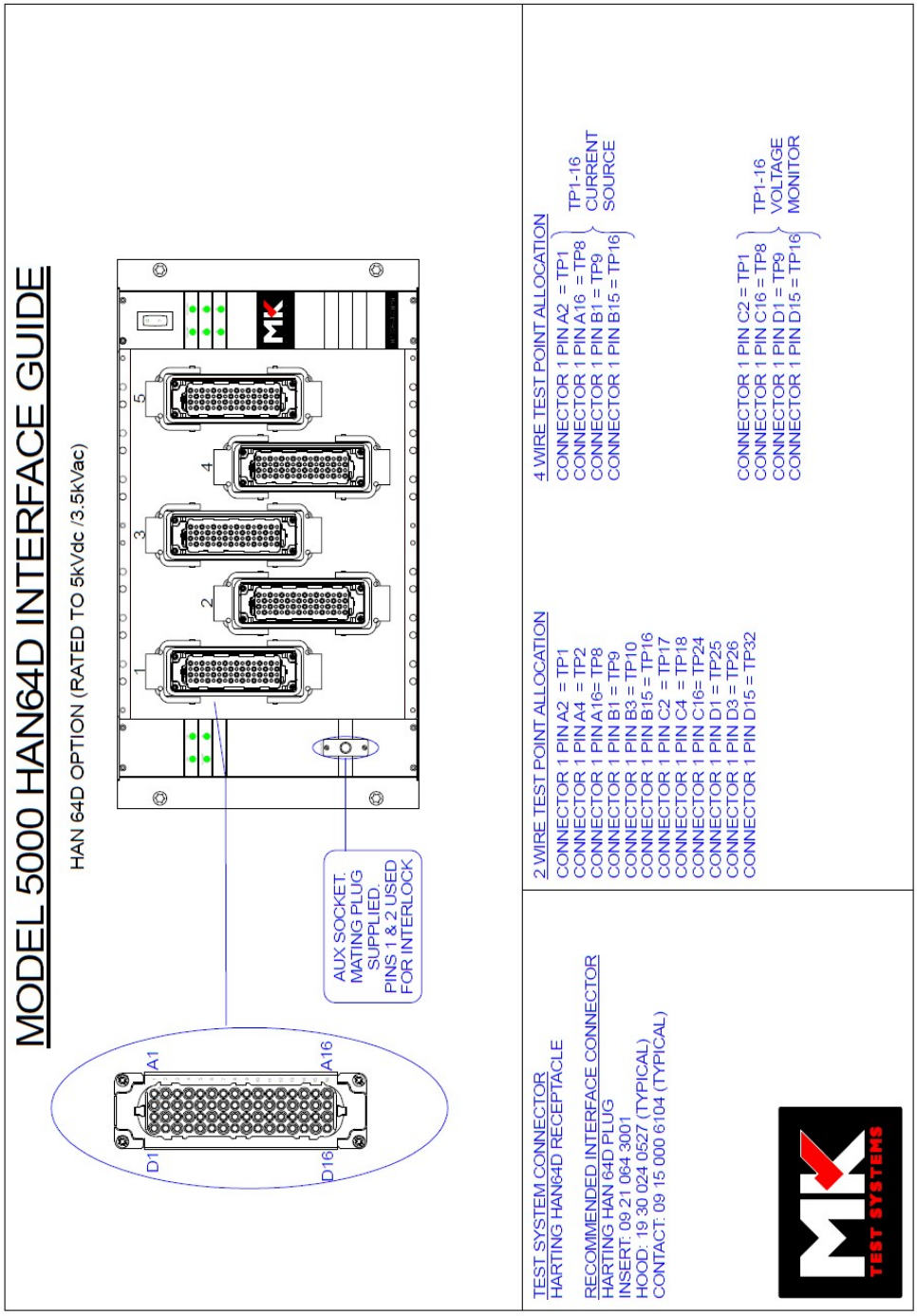
For Models 3500, 5000 & 8000 direct connection to the relay board is not normally recommended and is via either shroud or panel mounted terminals or connectors as follows:

Model 3500 – direct connection



9.1 Model 3500 & 5000 HAN64D Interface Options

Each HAN 64D Industrial Connector provides 32 x 2wire or 16 x 4 wire test points rated up to 5kVdc



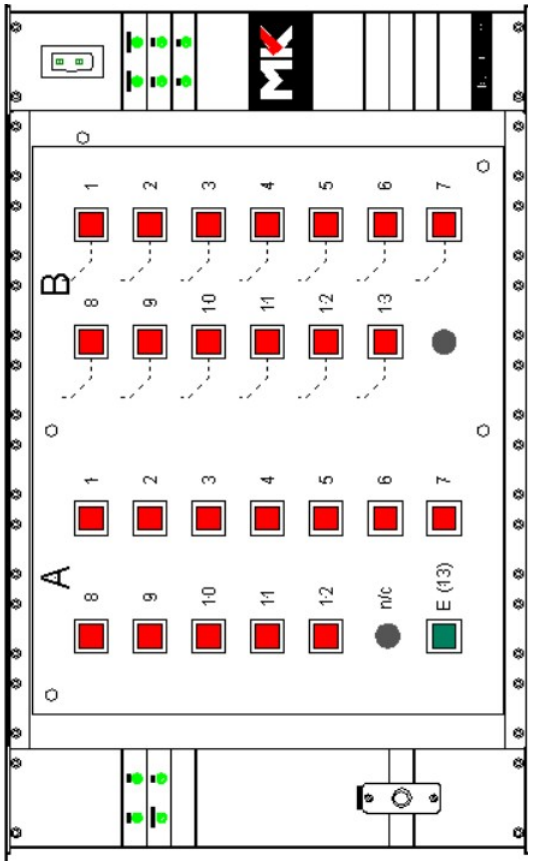
Use the following mating-half HAN parts:

Description	Harting Part Number	Quantity per connector
Connector Insert, male	09 21 064 3001	1
Male crimp pin, silver, 0.14- 0.37mm^2 *	09 15 000 6104	32
Connector Hood, side entry *	19 30 024 0527	1

* Typical part number – component variations available.

9.2 Model 5000/8000 Schutzinger ® Quick Release Terminal Posts

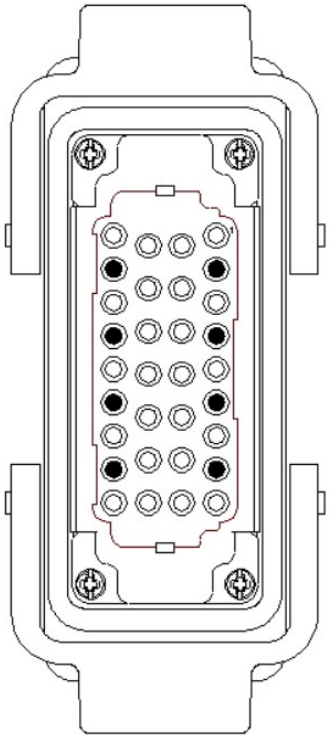
Typically provides up to 28 x 2 wire test points – per 6U shroud. Interface wires are connected via quick release terminals. This interface may be rated up to 8kVdc. Example shown below is fitted with 26 x 2 wire test points and dedicated earth connection:



9.3 Model 8000 HAN32EE

Each HAN32EE female connector (socket) provides 8 x 2 Wire test points:

Socket pins fitted in insert positions 2, 4, 6, 8, 24, 26, 28, & 30. All other insert positions are not fitted:



Use the following mating-half HAN parts:

Description	Harting Part Number	Quantity per connector
Connector Insert, male	09 32 032 3001	1
Male crimp pin, silver, 0.5mm^2 *	09 33 000 6121	8
Connector Hood, side entry *	19 30 016 0527	1

* Typical part number – component variations available.

10 Mixed Voltage Systems

Mixed voltage systems allow 2 different voltage rated systems – or Model types to be combined into one overall system. This is particularly useful when only a small number of test points must be rated at higher voltage compared to the majority of test points that only require a lower voltage rating. Typically, mixed systems combine Model 5000 with Model 2500 – where most test points are based on the Model 2500 design.

Mixed voltage systems allow different Model boards to be fitted in one subrack – subject to other criteria, or within a distributed system.

10.1 EHV (Extra High Voltage) Mode

Mixed voltage systems use the EHV (Extra High Voltage) feature to manage HV testing between the different system Model types.

Within MKAT software, when EHV mode is enabled, voltages above 2500Vdc or 1500Vac may be programmed for the Model 5000 test points in mixed voltage systems. During EHV mode all other test points selected as “TO” pins will be connected to electrical earth to protect them from excessive voltage. EHV mode enabled is indicated by front panel indicator – see specific system overview drawing.

When EHV is not selected all test points will be internally isolated from electrical earth and will be limited to 2500Vdc or 1500Vdc in hardware.

Note: for LV testing, including continuity & shorts tests – EHV mode should be disabled.

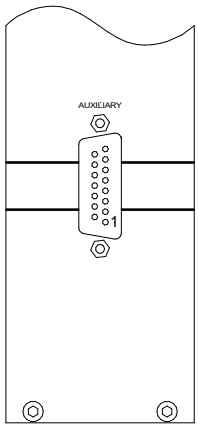
11 Auxiliary Connections

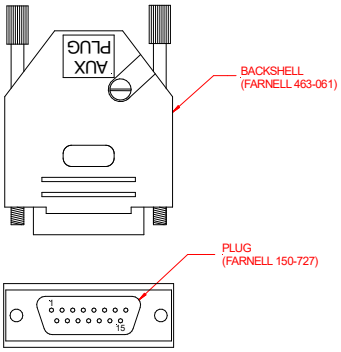
The main subrack has an auxiliary socket for various functions detailed below:

The connections for the interlock safety feature depend on the model of the AutoMeg unit.

The auxiliary socket is fitted to most systems on the left-hand side panel of the main system rack.

Figure 11-1 : Auxiliary Socket and Plug





The Auxiliary socket is provided for a variety of functions. The pin-out is shown in

Table 11-1 below.

Table 11-1 : Auxiliary Socket Pin-out

Pin	Function	Details	Which system uses it?
1 & 2	Interlock	Connect these two together for normal operation. If an interlock is used, it must be configured to connect these pins in 'SAFE' mode.	All systems when fitted
3 & 4	Extra HV Interlock	Connect these two together for normal operation. If an interlock is used, it must be configured to connect these pins in 'SAFE' mode.	Systems with HV of 6000V or more
5 & 6 7 & 8	HV AC frequency	Connect two resistors (>0.125W) of the same value, one for each pair of pins i.e., 5-6, 7-8. 25Hz – Not needed. 50Hz – 131k	Any with variable HV AC frequency module fitted.

		60Hz – 93.7k 400Hz – 8.8k For other frequencies use the following formula: R = 1/ ((frequency/ (3300000) - (1/133000))	
9	MBUS A	Connect to external supply for connection to any test point. See Note below	M Bus systems
10	MBUS B	Connect to external supply for connection to any test point. See Note below	M Bus systems
11	User Input 1	Active low 5-volt signal	Custom
12	User Input 2	Active low 5-volt signal	Custom
13	Not Used	This pin is reserved for future use	
14	0V		Systems with external humidity sensor
15	5V @ 10mA max		Systems with external humidity sensor

NOTE: For systems with built-in M Bus power supplies the Buses A and B are not wired to the auxiliary connector and are wired internally.

12 EM Boards

An EM or Excitation Module allows the operator to connect external power supplies or other test equipment to the UUT using MKAT software.

Two types of EM are currently available type AM4-0161 and AM4-0162.

The AM4-0161 EMs are rated at a maximum of 240V AC, 28V DC, 3A (internally fused) and provide 16 changeover contacts per board.

The AM4-0162 EMs are rated at a maximum of 240V AC, 28V DC, 12A. Each board provides 64 outputs which can be connected to either input connector Bus A, Bus B (not both together), and isolated.

12.1 EM Precautions

EM contacts MUST NOT be connected directly to product if the product is going to be stressed to potentials higher than the rating of the EM. In such cases, suitable external contactors must be used otherwise the EMs may be permanently damaged.

The EM configuration is extremely flexible, allowing the user access to measurement circuitry and power lines from the same test point. However, extreme care must be taken when designing the user interface, whether 2-wire or 4-wire, as it is possible to connect the sensitive measurement circuitry to a power line if a current path exists between two differently configured test points. This could cause damage to the AutoMeg equipment.

- When using EMs, it may be necessary to allow for the relay contact resistance if dealing with particularly tight tolerances.
- When using EMs connected to external power supplies, check the maximum supply voltage or current available does not exceed the rating of the EM board(s). In this situation it will be necessary to provide protection to prevent damage to the EM board(s).
- When programming EM contacts ensure the contacts are switched off after completion of the test.

12.2 EM Board - AM4-0161

This type of EM consists of normally open and normally closed contacts rated up to 5Adc @30Vdc. Each EM relay contact is protected via a 5A(T) rated 5x20mm ceramic fuse fitted on the board.

The EM has two 'D' connectors, which use pins 1 to 24 only, pins 25 to 37 are not used. Each EM has 16 changeover contacts available.

This type of EM is particularly useful as it allows a pin such as a relay coil to be measured as a test point and to be actuated by an external stimulus. Figure 4 shows an example of how such a system could be configured.

Figure 12-1 : Using an EM to configure a test point.

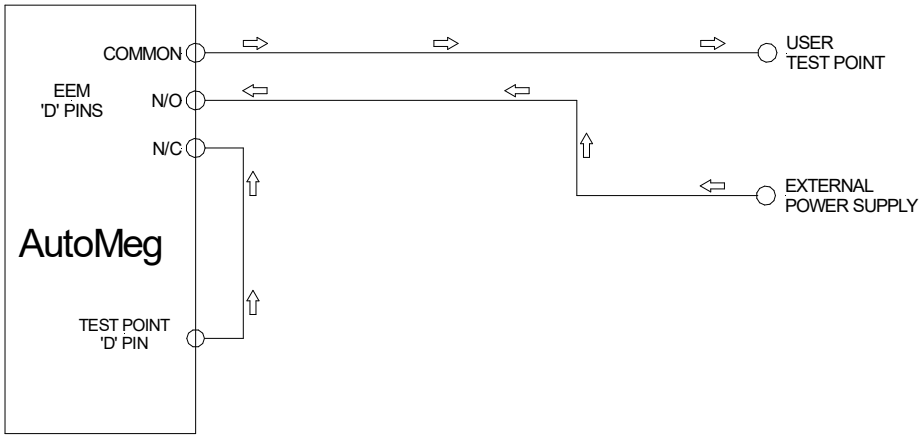
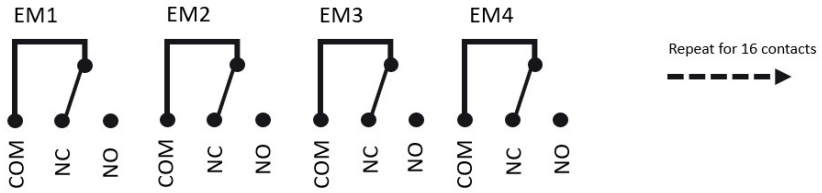


Table 12-1 : The front panel pin functions of an AM4-0161 EM module.

EM contact	'D' connector	Common	Normally open	Normally closed
1	Top	1	2	3
2	Top	4	5	6
3	Top	7	8	9
4	Top	10	11	12
5	Top	13	14	15
6	Top	16	17	18
7	Top	19	20	21
8	Top	22	23	24
9	Bottom	1	2	3
10	Bottom	4	5	6
11	Bottom	7	8	9
12	Bottom	10	11	12
13	Bottom	13	14	15
14	Bottom	16	17	18
15	Bottom	19	20	21
16	Bottom	22	23	24

AM4-0161 Overview

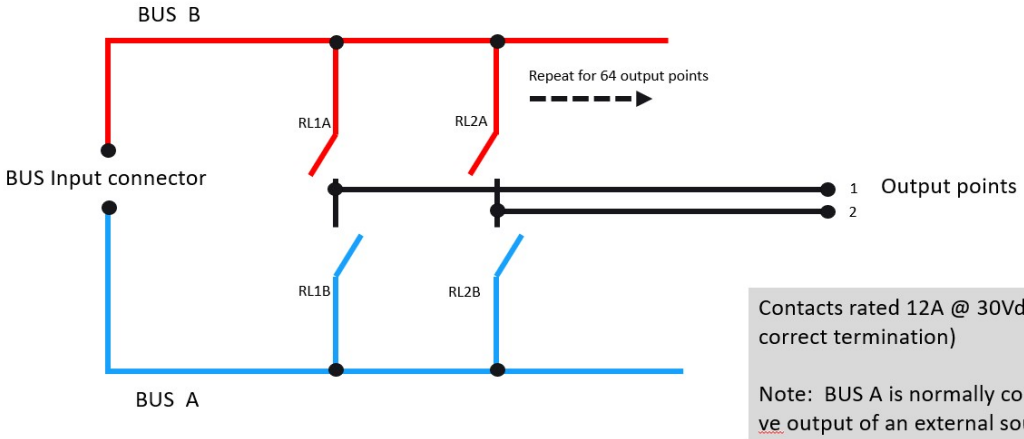


- ✓ All contacts rated up to 5A @ 30Vdc/250Vac
- ✓ Each EM board fitted with 2 off 37Way D Connectors. 8 x EM contacts per D connector (24 pins)
- ✓ Total 16 contacts per board – EM 1-8 (top D) EM9-16 (lower D).

12.3 EM Board - AM4-0162

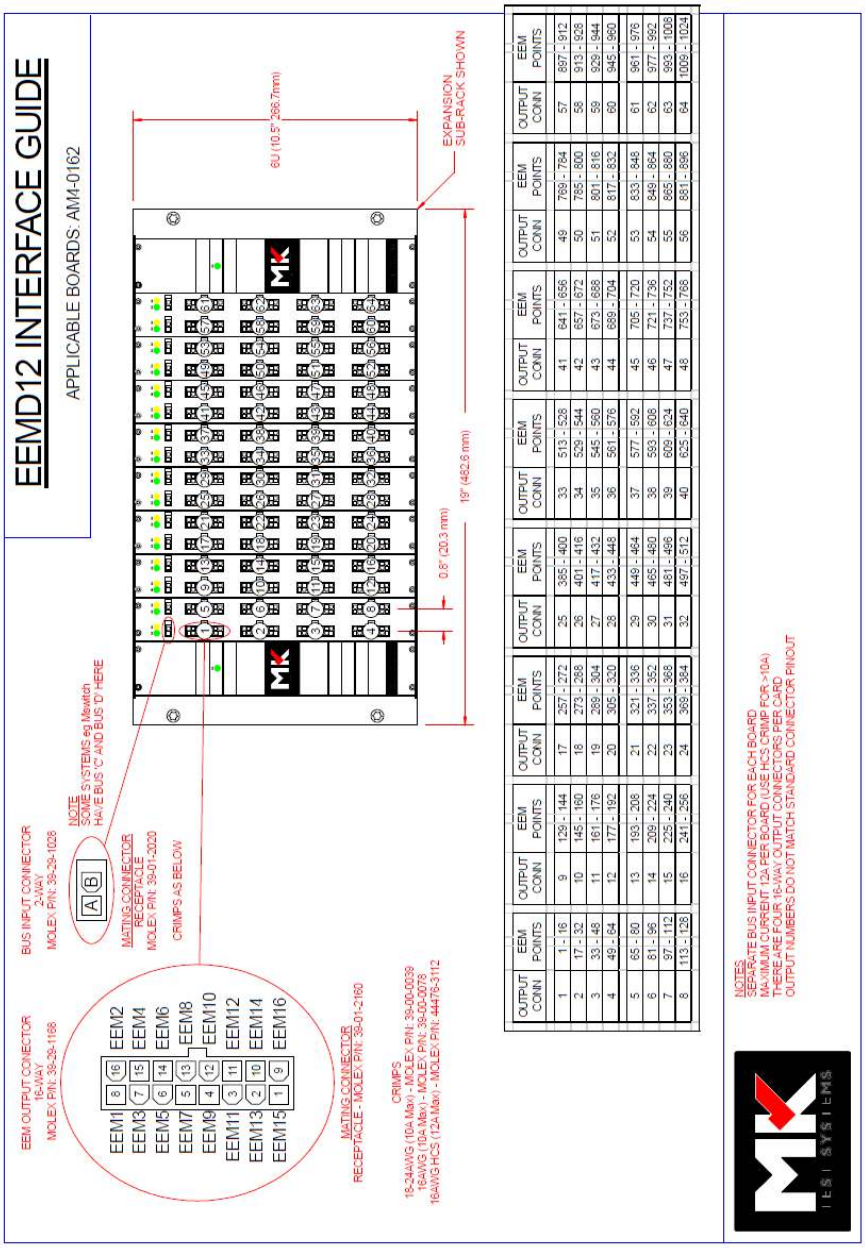
This type of EM consists of 128 normally open contacts configured as output 64 pins which can connected to one of two common bus inputs available on the front of the EM. The common bus inputs are designated in MKAT software as Bus A and Bus B. Each output pin can be connected to either Bus A or Bus B (but not both simultaneously), and neither. This module is designed to switch a maximum current up to 12Amps (total current). This type of EM board may be connected in parallel with relay board test points and wired to a user interface to create an MBUS system.

AM4-0162 Overview



Contacts rated 12A @ 30Vdc/ 250Vac (with correct termination)

Note: BUS A is normally connected to the –ve output of an external source.



OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS	OUTPUT CONN	EEM POINTS
1	1 - 16	9	129 - 144	17	257 - 272	25	385 - 400	33	513 - 528	41	641 - 656	49	769 - 784	57	897 - 912
2	17 - 32	10	145 - 160	18	273 - 288	26	401 - 416	34	529 - 544	42	657 - 672	50	785 - 800	58	913 - 928
3	33 - 48	11	161 - 176	19	289 - 304	27	417 - 432	35	545 - 560	43	673 - 688	51	801 - 816	59	929 - 944
4	49 - 64	12	177 - 192	20	305 - 320	28	433 - 448	36	561 - 576	44	689 - 704	52	817 - 832	60	945 - 960
5	65 - 80	13	193 - 208	21	321 - 336	29	449 - 464	37	577 - 592	45	705 - 720	53	833 - 848	61	961 - 976
6	81 - 96	14	209 - 224	22	337 - 352	30	465 - 480	38	593 - 608	46	721 - 736	54	849 - 864	62	977 - 992
7	97 - 112	15	225 - 240	23	353 - 368	31	481 - 496	39	609 - 624	47	737 - 752	55	865 - 880	63	993 - 1008
8	113 - 128	16	241 - 256	24	369 - 384	32	497 - 512	40	625 - 640	48	753 - 768	56	881 - 896	64	1009 - 1024

13 MBUS Board AM4-0241

The M Bus system has the capability of routing one of two external or internally wired supply lines (Buses) to any test point(s) during the test procedures. For example, the two buses may be connected to the output of a power supply to allow routing through to UUT connections.

This Bus connection for the AM4-0241 is rated up to a maximum current of 2A @ 30Vdc per board. Exceeding this maximum current may result in damage to both board and the system BUS.

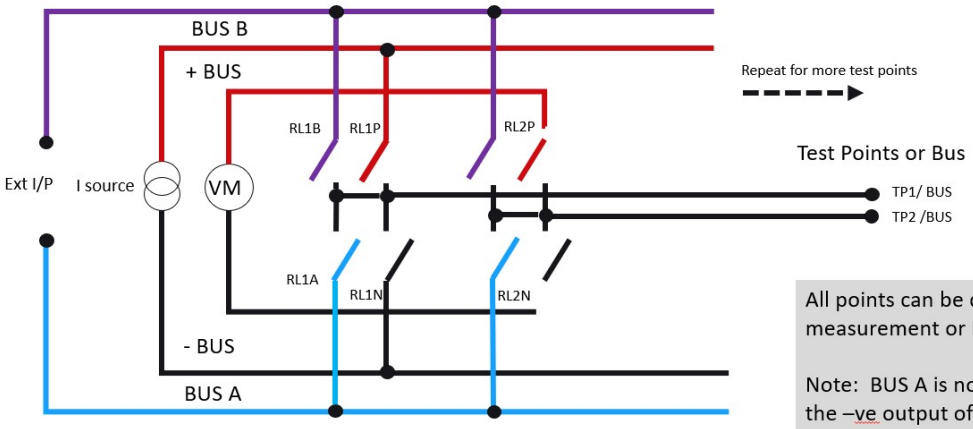
The external supplies are normally fed to the AutoMeg via an external connector or permanently wired to an internal power source.

These supplies should be isolated from all other circuits.

We strongly advise that power supplies connected to the BUS are protected or limited up to 2A to prevent damage to the AutoMeg test equipment.

The Mswitch configuration is extremely flexible, allowing the user access to measurement circuitry and power lines from the same test point. However, extreme care must be taken when designing the user interface, whether 2-wire or 4-wire, as it is possible to connect the sensitive measurement circuitry to a power line if a current path exists between two differently configured test points.

AM4-0241 Overview



All points can be connected internal measurement or BUS A or B

Note: BUS A is normally connected to the –ve output of an external source.

14 Distributed Systems

Distributed systems consist of a main control rack connected to a series of cells (or satellites) by umbilical cables.

The main control rack houses the computer, monitor and typically any extra power supplies. Normally the main rack houses at least one rack of switching modules.

Cells normally house switching modules and EMs only.

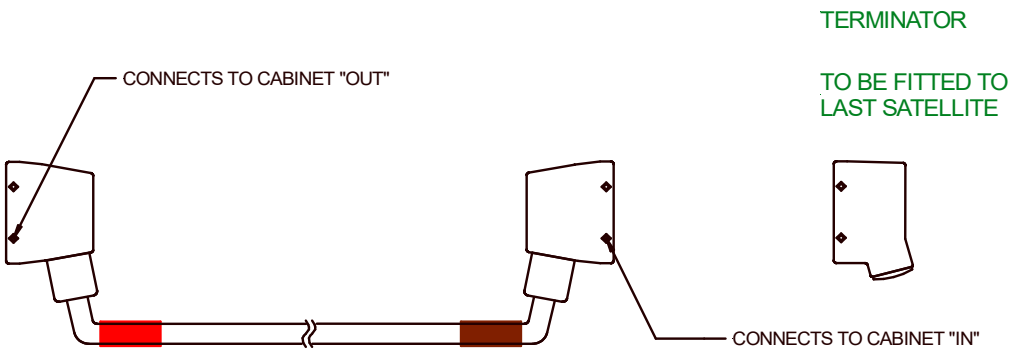
Depending on the configuration, it is possible to move cells from one system to another to increase the test point capability of a system. The individual cells must have their internal addresses changed accordingly by altering the internal address dip switch or external address switch (if fitted).

Normally cells are connected in a chain configuration. Please consult with the product supplier to confirm that cell moves are possible within the configuration and for further details on altering the internal addresses.

Do not unplug an umbilical cable whilst the AutoMeg is switched on. Ensure the AutoMeg is switched off for at least one minute before unplugging an umbilical cable.

14.1 Umbilical cables – Harting HAN

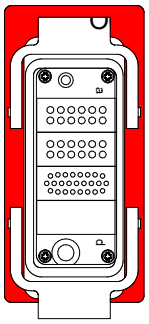
Umbilical cables of this design primarily connect the measurement and data bus between cabinets. In addition, they also provide connection of additional power buses and safety/ control signals. To complete the safety control circuit, a terminator plug must be fitted in the output socket on the last cabinet in the chain.



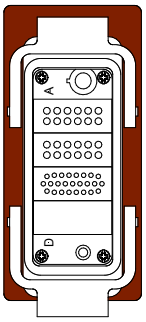
System Umbilical Connectors

The umbilical cable plugs and system sockets are colour coded as follows:

RED = Umbilical **OUT** (put)



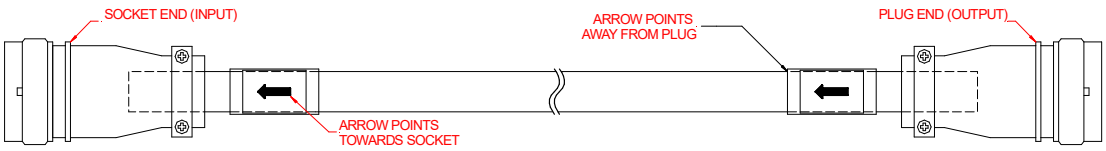
BROWN – Umbilical **IN** (put)



For systems above 2500Vdc/ 1500Vac and mixed voltage systems, an EHV variant umbilical cable is required.

14.2 Umbilical Cables – Souriau® Type

Umbilical cables of this type only connect measurement and data bus between cabinets. Fitting of a termination plug to the output socket of the last cabinet in the chain is not normally required as there is no provision for safety /control signals.



15 Hardware Options

15.1 Temperature probe

The temperature probe option allows the AutoMeg to measure and record the ambient temperature on test reports. The recorded ambient temperature reading may also be used for compensation of continuity resistance measurements.

The temperature probe is a third-party device and is subject to design change.

Configuration of the temperature probe is via the MKAT software.

15.2 Humidity probe

The humidity probe option allows the AutoMeg to measure and record the ambient humidity on test reports. The humidity probe may be incorporated into the temperature probe – see temperature probe.

The humidity probe is a third-party device and is subject to design change.

Configuration of the humidity probe is via the MKAT software.

15.3 Warning Beacon (Light) Cluster

Systems may be fitted with a warning beacon (or light) cluster to warn the operator and others of the system status. The warning beacon cluster may be fixed to the top of the equipment cabinet or in a separate module which is connected to the system via cable. For distributed systems, a warning beacon may be fitted on each cabinet and connected via the umbilical cable.

Each light represents the system status in the table below:

Beacon Light	**System Status**
Green	AC power supply ON
Yellow	Low Voltage testing in progress
Red (Flashing)*	High Voltage testing in progress

* An option for audible sounder is also available when HV testing is in progress

15.4 External LCR Meter (Capacitance and Inductance Measurement)

The LCR meter option allows the AutoMeg test system to perform capacitance and inductance measurements via system test points.

The LCR meter is a third-party device and is therefore subject to design change. The meter is normally mounted inside the equipment and all programming is via MKAT software.

Initial set up of the meter is performed via the MKAT software configuration page which specifies the type of meter and the communication method.

The LCR meter is normally connected via USB and is connected to the system measurement bus via a “Bus Isolation” module. The “Bus isolation” module ensures the LCR is only connected to the measurement bus during either capacitance or inductance measurements.

15.5 Active Xref Option

The Active Xref (cross – reference) function allows the test interfaces for the test program to be located by the control software, so the interfaces can be connected to the test system in any order.

16 Self-Test

Self-test is typically used to establish the correct operation of the AutoMeg unit, it tests the low voltage power supplies, the control sections, and the relay modules.

Indirectly, the self-test also verifies the 4-wire user interface but only at low voltage.

To perform a self-test, refer to the AutoMeg MKAT software manual.

Ensure that for 4-wire systems, the interface is connected. For two wire systems, the self-test will pass without the interface connected. For dual systems, the self-test can be operated in either two or four -wire mode.

16.1 Self-test failure

If self-test fails, then:

- If using a four-wire interface, check it is secure and wired correctly.
- Check applied current, voltage and resistance limits are correct in self-test set up page.
- If self-test fails all points, then contact MK Test Systems Ltd.
- If self-test persists in failing on one or more points, then proceed as follows:
- A good and correctly wired interface is essential for a 4-wire self-test to pass. Move the interface by one slot and repeat the self-test again. If the fault changes position, then the interface is suspect.

Investigate the Relay board:

- Return to the Main menu in the MKAT software.

- Switch off the unit.
- Detach the interface.
- Unscrew the fixing screws of the relay module (not the screws fixing the relay board to the front panel), attach blank connectors into the connectors on the module and ease the module free.
- Swap the module with the module to its right or left. If there is only one module consisting of two relay boards then detach the relay boards from the front panel and swap the boards.
- Plug the interface back in, switch on the unit and perform the self-test again.
- If the fault moves, then the relay module is suspect.
- If a relay module is found to be faulty or the fault cannot be isolated, then contact MK Test Systems Ltd.

17 Calibration

WARNING – The calibration process may require measurement of high voltage. Do not touch the calibration adaptor, interface, test leads or instrumentation during measurement.

17.1 Calibration Overview

The AutoMeg test system should be calibrated annually unless otherwise stated. Calibration should be performed by a qualified /trained user.

Calibration is completed by performing the MK Calibration Verification process.

Calibration Adjustment should only be performed on individual parameters that are found to be outside of specification during the verification process. Calibration Adjustment should not normally be required and may indicate a problem with system hardware. Great care should be taken when performing calibration adjustment(s) and should only be performed by a qualified / trained user.

17.2 Environmental Conditions

MK Equipment is designed to operate and meet stated specification sheet accuracy if used within the specified environmental conditions. It is therefore essential the calibration process, and any adjustment, is only performed within the following environmental conditions:

Environmental Conditions	Min	Max
Temperature	10°C	30°C
Humidity (RH non-condensing)	30%	80%
Altitude (above sea level)	<2000m	

The temperature at the time of calibration must be recorded on the calibration certificate. Humidity readings are optional.

17.3 System stabilisation

Calibration should be performed after at least 10 minutes after the system has been switched on.

17.4 Calibration Verification

Calibration is performed by following the MK Calibration Verification process. Calibration Verification runs a verification test program in the MKAT Runner. The calibration verification test program is supplied with the system and used to compare system measurements with those on a calibrated instrument(s).

The verification test program verifies both MK Test System outputs e.g. LV current or HVDC voltage and inputs e.g. voltmeter or ammeter with the calibrated instrument(s). The verification test program prompts the user to enter the calibrated instrument readings, compares with MK system readings or set values and will report a Pass/ Fail status based on the system specification. If all readings are within specification i.e. Pass, they may be used to create a Calibration Certificate.

See Calibration section in the MKAT Runner User Manual for further details regarding calibration verification.

17.5 Calibration Test Equipment

When the calibration verification test program is run, operator instructions will guide the user through the progress. Please follow these instructions carefully, as these are specific to the equipment and required processes.

In general, the Calibration verification process will require the following calibration test equipment.

Calibration Adaptor or Interface

The calibration adaptor or interface is normally supplied with the MK test system. This provides an electrical interface between the test system and the calibrated instrument(s). Both calibration adaptors and calibration interfaces **do not require calibration** as they only provide a method of connection between the MK equipment and the Calibration test equipment. On-board load resistors are only used to provide a nominal connection path, and the absolute resistance value is not critical. Any connection path failure (including on-board resistor) will be identified during the calibration process. All calibration adaptors and interfaces are fitted with at least two off 4mm terminals (red & black) to connect the calibration test equipment.

The serial number of the calibration adaptor or interface should be noted the “Other Equipment Used” section on the Calibration Certificate.

Typical Calibration Adaptor

17.6 Calibration Multimeter

A multimeter is required for MK Equipment calibration. The multimeter must have a specification exceeding that of the MK Equipment being calibrated or adjusted. The multimeter should have a valid calibration certificate.

The following mustimeters are suitable for calibration and adjustment of MK Equipment. Note this list is for guidance only:

Manufacturer	Model number
Fluke	187
Fluke	189
Fluke	287
Fluke	289

17.7 High Voltage Probe

A high voltage probe may be required for calibration of HVDC & HVAC system power supplies. The high voltage probe should have suitable voltage specification and be compatible for use with the calibration multimeter. High voltage probe should ideally be calibrated with the multimeter used.

18 Safety Test

The AutoMeg test system should be electrical safety (PAT) tested annually by a qualified person. It is the responsibility of the end user to arrange and perform this activity. If the system is supplied with detachable power lead, the system is tested with this lead.

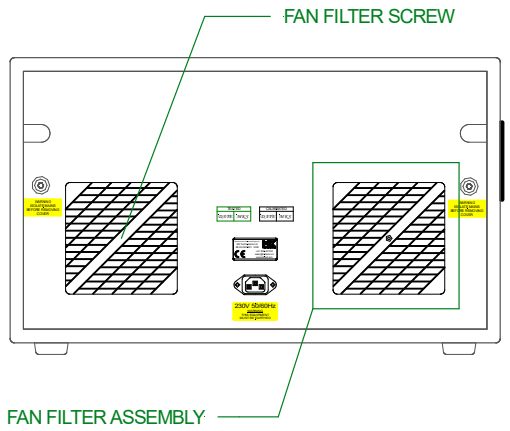
The AutoMeg test system should be test as a Class 1 appliance.

19 Routine Maintenance

Routine maintenance is recommended.

19.1 Fan Filters

When fitted, fan filters should be inspected, cleaned, or replaced where necessary. Fan Filters are normally located on the system rear panel. Remove each filter by un-securing the central screw show below. Unclip the filter assembly and remove the white filter membrane. Clean or replace membrane and the filter assembly components. Replace assembly and re-secure using central screw.



Fan Filter replacement part no: Farnell 117-1798 (pack of 5)

19.2 Cleaning

Extreme care should be taken when cleaning near or adjacent to the system test point interface connector(s). We do not advise using cleaning solvents in this area. Using a clean dry brush for removal of dust is normally sufficient.

For cleaning the cabinet metalwork, we recommend applying a small quantity of anti-static foam cleaner and wiping clean with a lint-free cloth.

20 Troubleshooting Guide

20.1 When connected to AC power supply AutoMeg does not power up using MKAT software.

Q: With AC power supply connected and rocker switch in “1” (or ON) position is the STANDBY LIGHT ON?

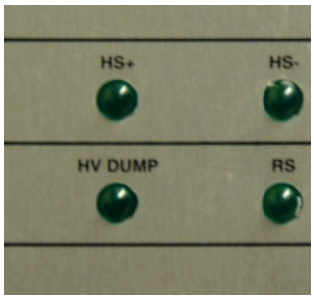
A: YES: AC power supply OK and correct voltage. Check control cable (see below) and/or PCI card connected correctly.

A: NO: Check power supply OK. If system has a MDU fitted check all circuit breakers are ON and illuminated. Press green start “1/0” button if fitted. If not check all safety devices are reset or fitted. e.g. E-stop reset & Interlock plug fitted. Investigate internal sub-rack AC supply protection fuse – not user replaceable.

Contact MK Test Systems or your local agent if your system does not power up after you have performed the above checks.

20.2 Front Panel Checks

Main Rack LED / Rocker Switch



Main Right Hand Expansion Left & Right Hand Panel

Main Left Hand Panel LEDs:

- **STANDBY**: Standby mode. AC power is applied to the system but the control software is not running, or it is not connected to the PC.
- **ACTIVATE:** Signal received from the PC to fully power the hardware
- **MS+**: Measurement power rail +15V present

- **MS-:** Measurement power rail -15V present
- **CS:** Current source power for LV present
- **RS:** Relay RHS power rail +12V present
- **HS+:** HV power rail +24V present
- **HS**-: HV power rail -24V present
- **HV DUMP**: HV dump system activated

20.3 Data Cable Checks

Check the control cable (AM4-0261) 50 Way D Plug at the rear of the PC is correctly connected into the PCI card socket. It is important that the plug is fully seated, and the screw-locks are hand-tightened. See photo below:

21 Waste Disposal

21.1 Packaging

Packaging materials must be disposed of as prescribed by the current local regulations.

21.2 Equipment

In the European Economic Area (EEA) the disposal of waste equipment is regulated in the "**Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE).**" The official journal on this matter is available on the European Parliament's homepage.

The symbol for the separate collection of electrical and electronic equipment is a crossed-out waste bin. Disposal with household waste (unsorted waste) or similar collections of municipal waste is not permitted!

Contact an authorised waste disposal contractor in your country.

22 Notes