

Automatic Test System

ATS 400

ApplicationNote Matrix Card 206718



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2 General Information

2.1 Scope of this document

This document covers the information a programmer needs to use the Matrix Card 2230-25-1P-16 within his application.

This document also covers using the expansion modules [MATRIX-CARD-EXT-1K-CNC](#) (article number 206639) and [MATRIX-CARD-EXT-1K-CCC](#) (article number 208878).

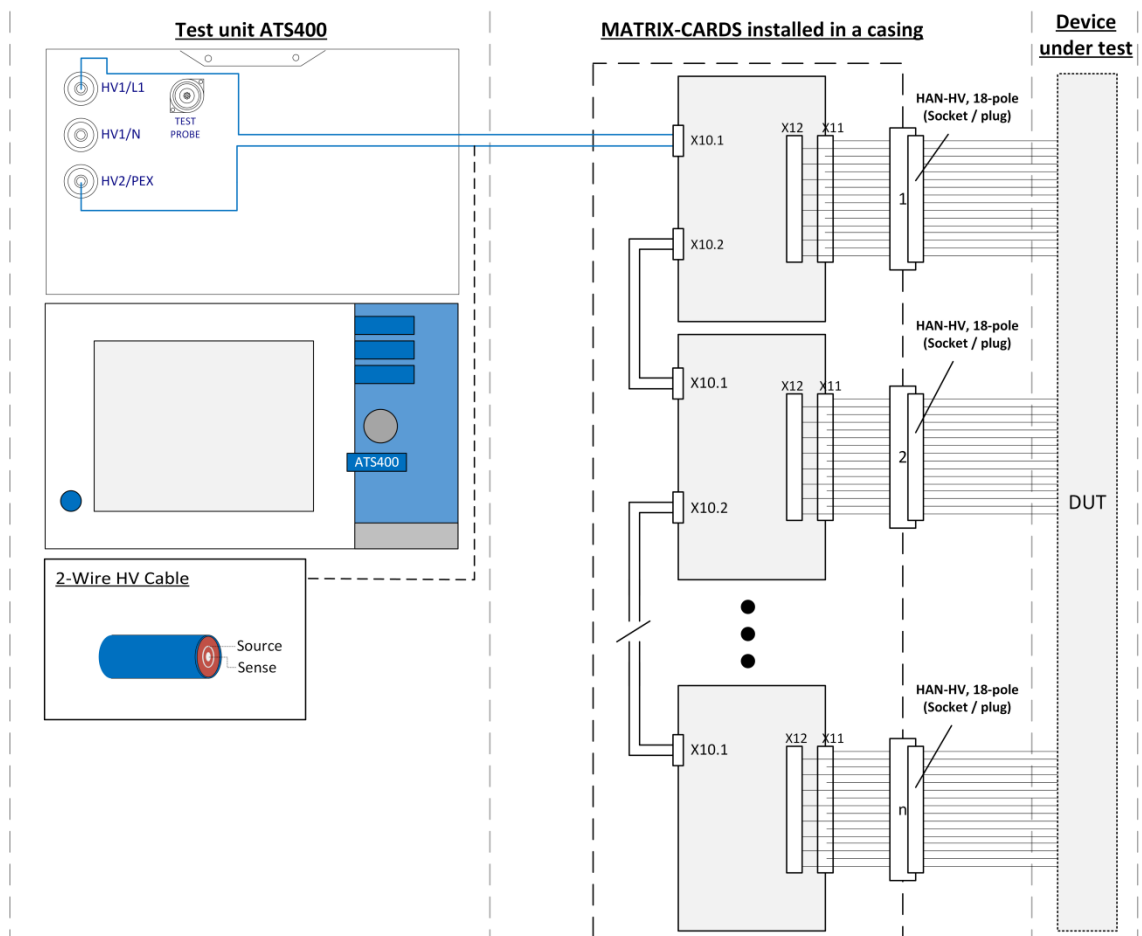
This document describes using the [driver DLL](#), the [.Net assembly](#), the [LabVIEW driver](#) and the [ASCII command interface](#).

2.2 Related documentation

You need the driver programming manual for the driver you purchased. It contains information how the function calls or commands are used within a test and how to calculate the relay settings.

You may also need the schematic diagram for the expansion module if applicable.

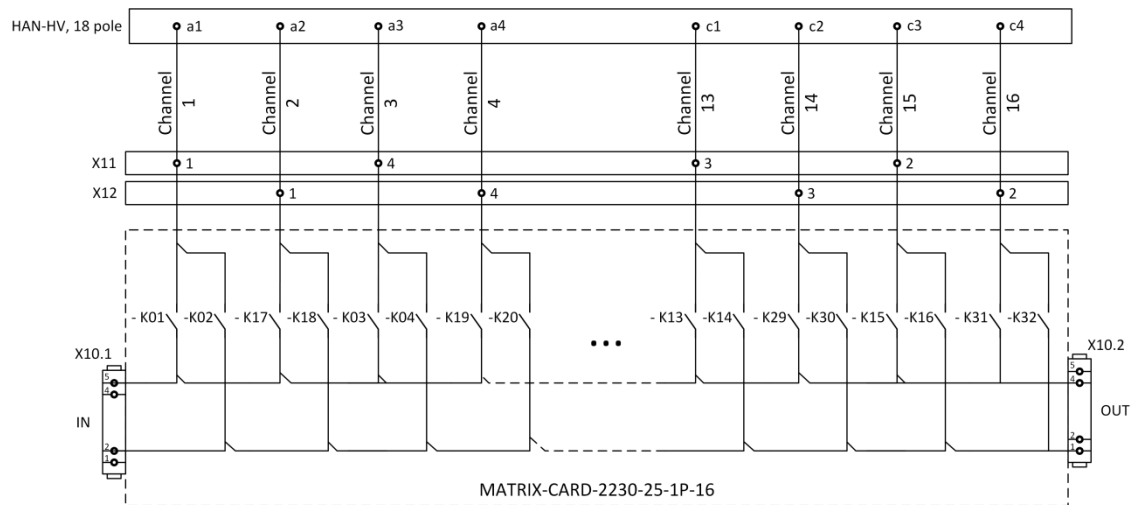
2.3 Schematic diagram: TEST UNIT – MATRIX – DUT



The connections between TEST UNIT and MATRIX are HV1/L1 and HV2/PEX.

The connections between MATRIX and DUT are via HAN-HV, 18 pole.

2.4 Schematic diagram: MATRIX-CARD-2230-25-1P-16



Schematic diagram of one matrix module. X10 is connected to the TEST UNIT. X11 and X12 are connected to the DUT.

The input X10.1 Pin 5 is connected to the HV1/L1 output of the ATS400 without using any of the expansion modules.

The input X10.1 Pin 1 is connected to the HV2/PEX output of the ATS400 without using any of the expansion modules.

2.5 Connecting the matrix

Internally the matrix connects the input IN (X10.1) to its outputs (X11 and X12). X11 and X12 are connected to Harting socket HAN-HV, 18 pole.

You need to set one or a group of relay to make a connection from input to output. To connect HV1/L1 to output pin a1 relay K01 has to be set. To operate a high voltage test from a1 to a2 relay K01 and K18 has to be set.

The following table shows which relay has to be set for the wanted connection:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18
Channel 3 Source	a3	K03	K04
Channel 4 Source	a4	K19	K20
Channel 5 Source	a5	K05	K06
Channel 6 Source	a6	K21	K22
Channel 7 Source	b1	K07	K08
Channel 8 Source	b2	K23	K24
Channel 9 Source	b3	K09	K10
Channel 10 Source	b4	K25	K26
Channel 11 Source	b5	K11	K12
Channel 12 Source	b6	K27	K28
Channel 13 Source	c1	K13	K14
Channel 14 Source	c2	K29	K30
Channel 15 Source	c3	K15	K16
Channel 16 Source	c4	K31	K32

Table 1: Connection table.

The relay number used for calculating the bits for the drivers or ASCII command is calculated by the formula:

$$M = (N - 1) * 32 + K$$

Where

M = relay number (for programming the drivers or ASCII commands)

N = module number

K = relay number in the module (see Table 1: Connection table)

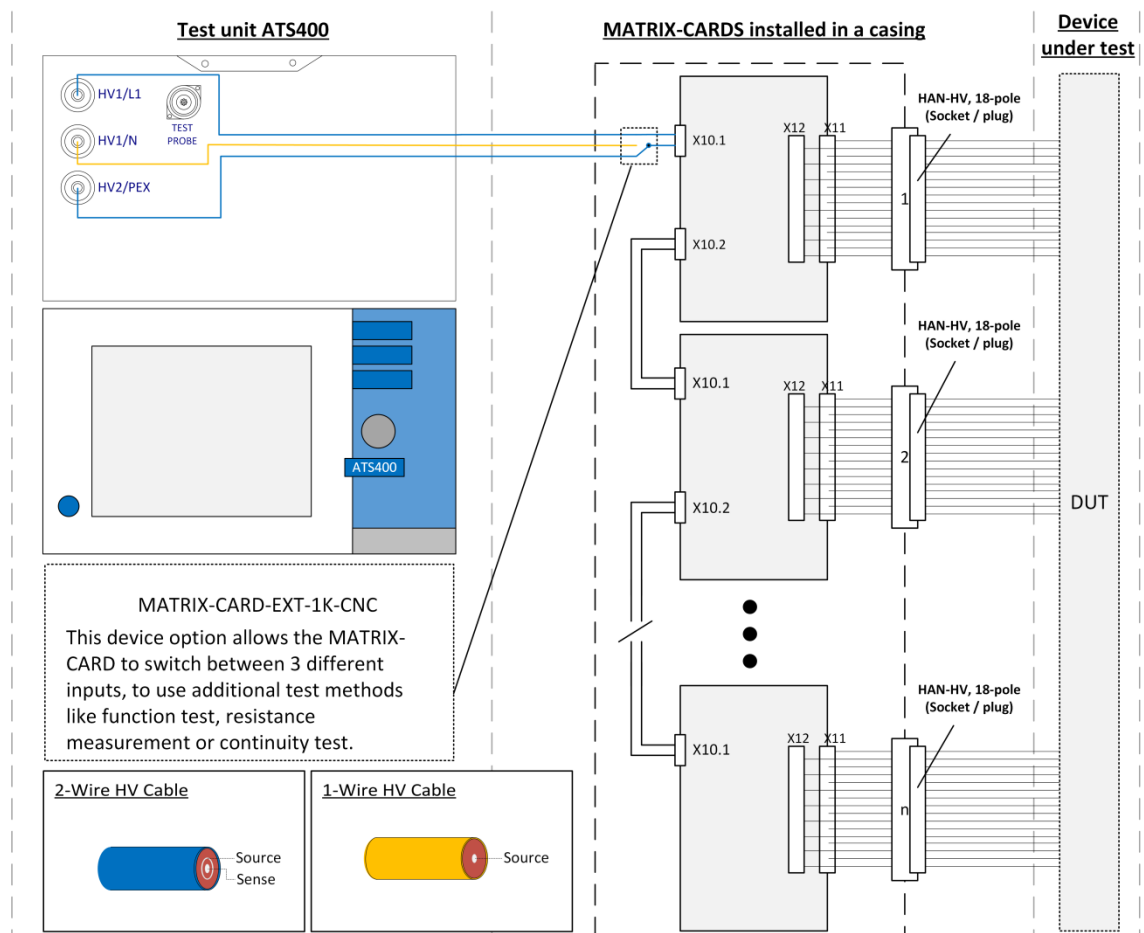
Example, Relay K12 on the second relay module has number 44:

$$N = 2, K = 12$$

$$M = (2 - 1) * 32 + 12 = 44$$

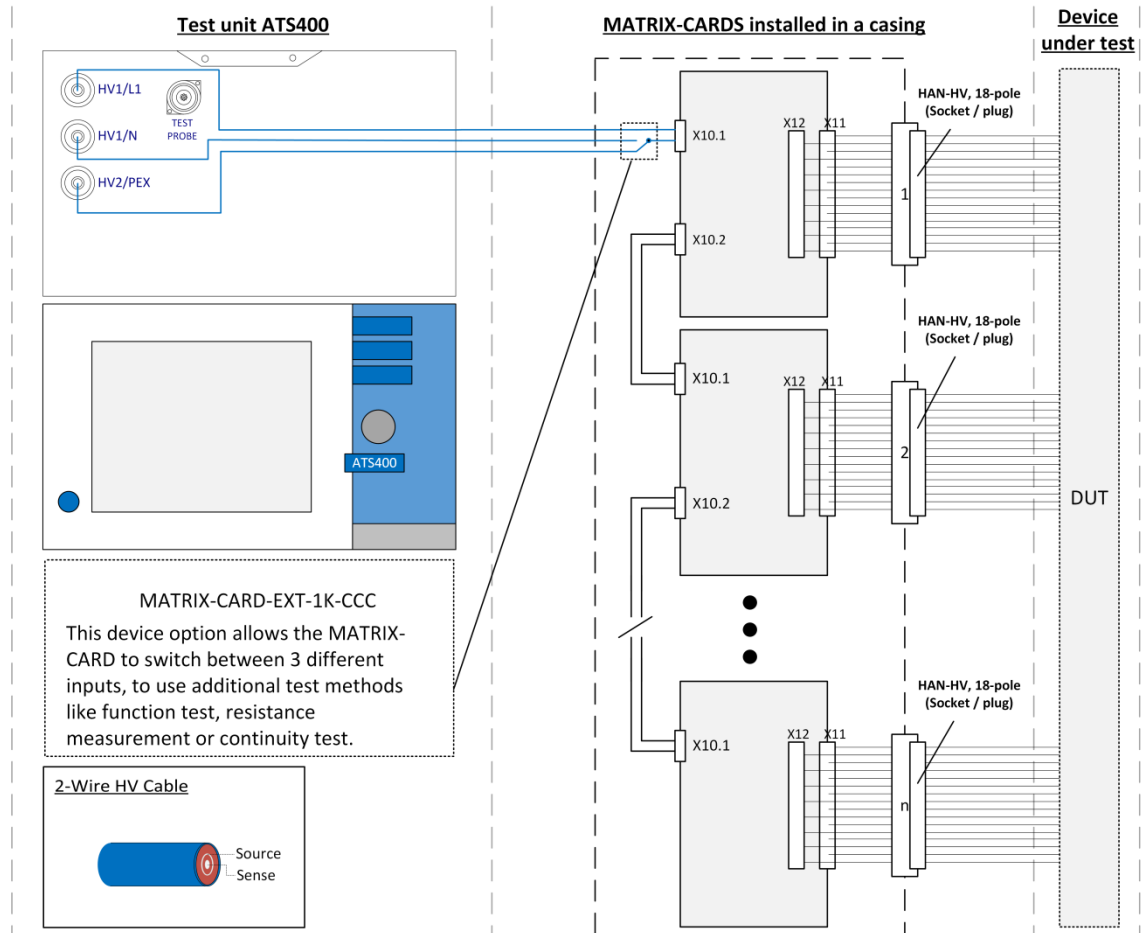
2.6 MATRIX-CARD-EXT-1K-CNC

To use additional test methods like function test, leakage current test, continuity test or resistance test it is necessary to switch the input (X10.1 Pin 1) from HV2/PEX to HV1/N (outputs TEST UNIT). For using the function of expansion modules MATRIX-CARD-EXT-1K-CNC the internal expansion relay EXT-MC1-K1 has to be switched by driver or ASCII command.



2.7 MATRIX-CARD-EXT-1K-CCC

To use additional test methods like function test, leakage current test, continuity test or resistance test it is necessary to switch the input (X10.1 Pins 1 and 2) from HV2/PEX to HV1/N (outputs TEST UNIT). For using the function of expansion modules MATRIX-CARD-EXT-1K-CCC the internal expansion relay EXT-MC1-K1 has to be switched by driver or ASCII command.



Important

These relays are not reset automatically when sending new connections. If you are using them you must also reset them.

See the following examples for a correct sequence for the commands or function calls.

3 Driver DLL

Using the Driver DLL there are 2 ways to use the matrix.

1. As additional parameter in a test method like f.e. high voltage test
2. As a single command to just switch the matrix

3.1 Using as part of a test

This is done by calling the `ETLKWPSetMatrix` function. Call this function after calling the parameter download function of the test. The `ISO_Relais_Example` is a complete example supplied with the driver.

You must supply the relay matrix type, the number of modules, the connection in the matrix and start the setting.

3.1.1 One relay module / no expansion relais

For making a measurement between Channel 1 and Channel 2 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

The function call is as follows:

```
/* Variables needed, other values are constant */
unsigned char DeviceType = 0x53;
unsigned short RelaisSetting[] = {0, 0};

/* Settings the relais */
RelaisSetting[0] = 1; // Relais K1
RelaisSetting[1] = 2; // Relais K18
ETLKWPSetMatrix (DeviceType, 1, 4, 1, 2, RelaisSetting);
```

The expansion relais are unchanged.

3.1.2 One module using expansion relais EXT-MC1-K1

For making a measurement between Channel 3 and Channel 4 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 3 Source	a3	K03	K04
Channel 4 Source	a4	K19	K20

The function call is as follows:

```
/* Variables needed, other values are constant */
unsigned char DeviceType = 0x53;
unsigned short RelaisSetting[] = {0, 0};
unsigned short ExtRelaisSetting[] = {0};

/* Setting the relais */
RelaisSetting[0] = 4; // Relais K3
RelaisSetting[1] = 8; // Relais K20
ETLKWPSetMatrix (DeviceType, 1, 4, 1, 2, RelaisSetting);
```

```
/* Setting the extended relais */
ExtRelaisSetting[0] = 1; // Extended relais K1
ETLKWPSetExtendedRelais (DeviceType, 1, 1, ExtRelaisSetting);
```

The expansion relais 1 is set and expansion relais 2 is reset.

3.1.3 Two relay modules / no expansion relais

For making a measurement between Channel 17 (Channel 1 / 2. relay module) and Channel 18 (Channel 2 / 2. relay module) you have to set the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 17 Source	a1	K33	K34
Channel 18 Source	a2	K49	K50

The function call is as follows:

```
/* Variables needed, other values are constant */
unsigned char DeviceType = 0x53;
unsigned short RelaisSetting[] = {0, 0, 0, 0};

/* Settings the relais */
RelaisSetting[0] = 0; // No relais to set
RelaisSetting[1] = 0; // No relais to set
RelaisSetting[2] = 1; // Relais K33 on second module
RelaisSetting[3] = 2; // Relais K50 on second module
ETLKWPSetMatrix (DeviceType, 1, 4, 2, 4, RelaisSetting);
```

The expansion relais are unchanged.

3.2 Using as single command

This is done by calling the `ETLKWPSetMatrixPermanent` function. The [Relais_Permanent_Example](#) is a complete example supplied with the driver.

You must supply the relay matrix type, the number of modules, the connection in the matrix and start the setting.

3.2.1 One relay module / no expansion relais, permanent

For making a measurement between Channel 1 and Channel 2 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

The function call is as follows:

```
/* Variables needed, other values are constant */
unsigned char DeviceType = 0x51;
unsigned short RelaisSetting[] = {0, 0};

/* Settings the relais */
RelaisSetting[0] = 1; // Relais K1
RelaisSetting[1] = 2; // Relais K18
ETLKWPSetMatrixPermanent (DeviceType, 1, 4, 1, 2, RelaisSetting);
```

The expansion relays are unchanged.

3.2.2 Two relay modules / no expansion relays, permanent

For making a measurement between Channel 17 (Channel 1 / 2. relay module) and Channel 18 (Channel 2 / 2. relay module) you have to set the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 17 Source	a1	K33	K34
Channel 18 Source	a2	K49	K50

The function call is as follows:

```
/* Variables needed, other values are constant */
unsigned char DeviceType = 0x51;
unsigned short RelaisSetting[] = {0, 0, 0, 0};

/* Settings the relais */
RelaisSetting[0] = 0; // No relais to set
RelaisSetting[1] = 0; // No relais to set
RelaisSetting[2] = 1; // Relais K33 on second module
RelaisSetting[3] = 2; // Relais K50 on second module
ETLKWPSetMatrixPermanent (DeviceType, 1, 4, 2, 4, RelaisSetting);
```

The expansion relays are unchanged.

4 .Net assembly

Using the .Net assembly there are 2 ways to use the matrix.

3. As additional parameter in a test method like f.e. high voltage test
4. As a single command to just switch the matrix

To use the matrix you need version 4.0.28 or newer.

4.1 Using as part of a test

This is done by calling the `ETLKWPSetMatrix` function. Call this function after calling the parameter download function of the test. The `DEMO-HV-Matrix` is a complete example supplied with the .Net assembly.

You must supply the relay matrix type, the number of modules, the connection in the matrix and start the setting.

4.1.1 One relay module / no expansion relais

For making a measurement between Channel 1 and Channel 2 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

The function call is as follows:

```
/* Variables needed, other values are constant */
byte DeviceType = 0x53;
ushort[] RelaisSetting = new ushort[2];

/* Settings the relais */
RelaisSetting[0] = 1; // Relais K1
RelaisSetting[1] = 2; // Relais K18
ETLKWPSetMatrix (DeviceType, 1, 4, 1, 2, RelaisSetting);
```

The expansion relais are unchanged.

4.1.2 One module using expansion relais EXT-MC1-K1

For making a measurement between Channel 3 and Channel 4 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 3 Source	a3	K03	K04
Channel 4 Source	a4	K19	K20

The function call is as follows:

```
/* Variables needed, other values are constant */
byte DeviceType = 0x53;
ushort[] RelaisSetting = new ushort[2];
ushort[] ExtRelaisSetting = new ushort[1];

/* Setting the relais */
RelaisSetting[0] = 4; // Relais K3
```

```
RelaisSetting[1] = 8; // Relais K20
ETLKWPSetMatrix (DeviceType, 1, 4, 1, 2, RelaisSetting);

/* Setting the extended relais */
ExtRelaisSetting[0] = 1; // Extended relais K1
ETLKWPSetExtendedRelais (DeviceType, 1, 1, ExtRelaisSetting);
```

The expansion relais 1 is set and expansion relais 2 is reset.

4.1.3 Two relay modules / no expansion relais

For making a measurement between Channel 17 (Channel 1 / 2. relay module) and Channel 18 (Channel 2 / 2. relay module) you have to set the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 17 Source	a1	K33	K34
Channel 18 Source	a2	K49	K50

The function call is as follows:

```
/* Variables needed, other values are constant */
byte DeviceType = 0x53;
ushort[] RelaisSetting = new ushort[4];

/* Settings the relais */
RelaisSetting[0] = 0; // No relais to set
RelaisSetting[1] = 0; // No relais to set
RelaisSetting[2] = 1; // Relais K33 on second module
RelaisSetting[3] = 2; // Relais K50 on second module
ETLKWPSetMatrix (DeviceType, 1, 4, 2, 4, RelaisSetting);
```

The expansion relais are unchanged.

4.2 Using as single command

This is done by calling the `ETLKWPSetMatrixPermanent` function.

You must supply the relay matrix type, the number of modules, the connection in the matrix and start the setting.

4.2.1 One relay module / no expansion relais, permanent

For making a measurement between Channel 1 and Channel 2 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

The function call is as follows:

```
/* Variables needed, other values are constant */
byte DeviceType = 0x53;
ushort[] RelaisSetting = new ushort[2];

/* Settings the relais */
RelaisSetting[0] = 1; // Relais K1
RelaisSetting[1] = 2; // Relais K18
```

```
ETLKWPSetMatrixPermanent (DeviceType, 1, 4, 1, 2, RelaisSetting);
```

The expansion relais are unchanged.

4.2.2 Two relay modules / no expansion relais, permanent

For making a measurement between Channel 17 (Channel 1 / 2. relay module) and Channel 18 (Channel 2 / 2. relay module) you have to set the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 17 Source	a1	K33	K34
Channel 18 Source	a2	K49	K50

The function call is as follows:

```
/* Variables needed, other values are constant */
byte DeviceType = 0x53;
ushort[] RelaisSetting = new ushort[4];

/* Settings the relais */
RelaisSetting[0] = 0; // No relais to set
RelaisSetting[1] = 0; // No relais to set
RelaisSetting[2] = 1; // Relais K33 on second module
RelaisSetting[3] = 2; // Relais K50 on second module
ETLKWPSetMatrixPermanent (DeviceType, 1, 4, 2, 4, RelaisSetting);
```

The expansion relais are unchanged.

5 LabVIEW driver

Using the LabVIEW there are two ways to use the matrix.

You can use the matrix as part of the parameters of a test or as a command to just switch the matrix.

5.1 Using as part of a test

This is done by calling the [ETLKWPSetMatrix](#) VI and the [ETLKWPSetExtendedRelais](#) if applicable. Call these VIs after calling the parameter download VI of the test. The example [HV-Test_With_Matrix](#) is a complete example supplied with the driver.

You must supply the relay matrix type, the number of modules, the connection in the matrix, the expansion relay if applicable and start the setting.

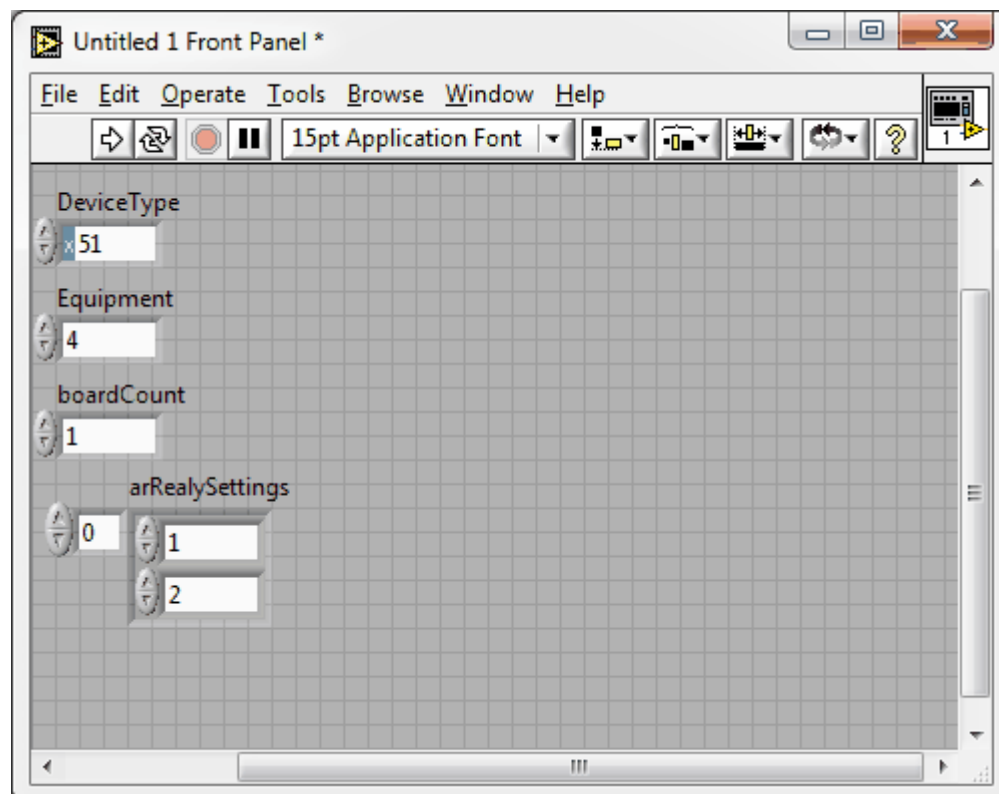
5.1.1 One module / no expansion relais

For making a measurement between Channel 1 and Channel 2 you must use the relais according to the following table abstract:

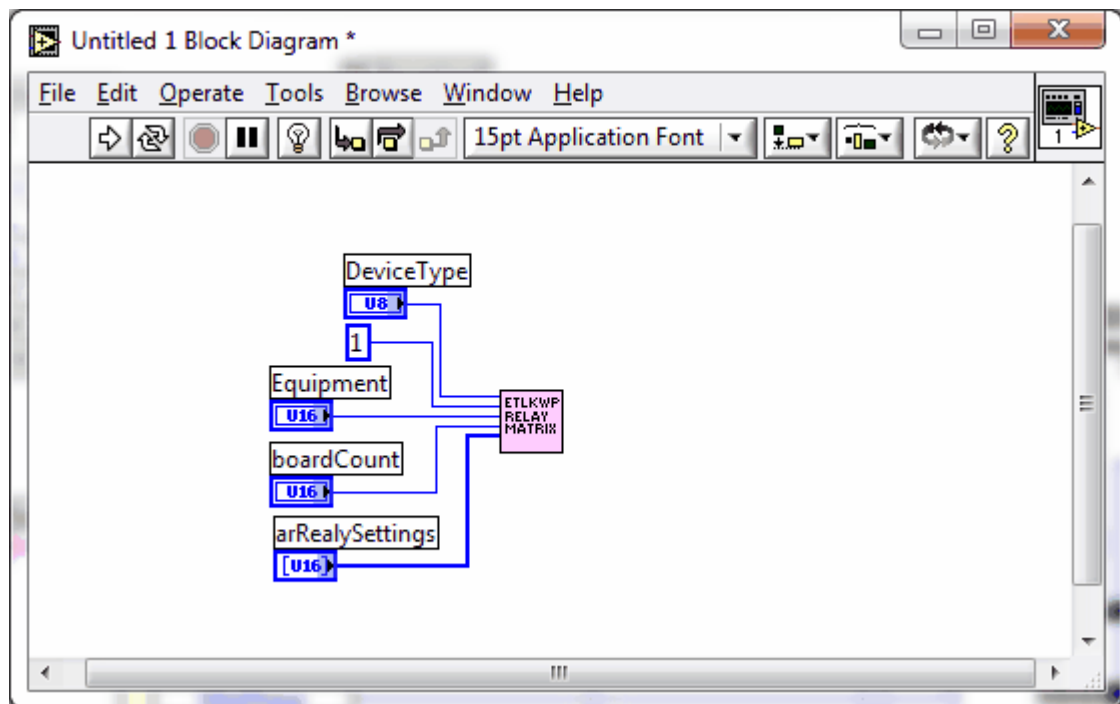
	Output	ATS400	
		HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

The VI call is as follows:

Front Panel:



Block diagram:



The expansion relais are unchanged.

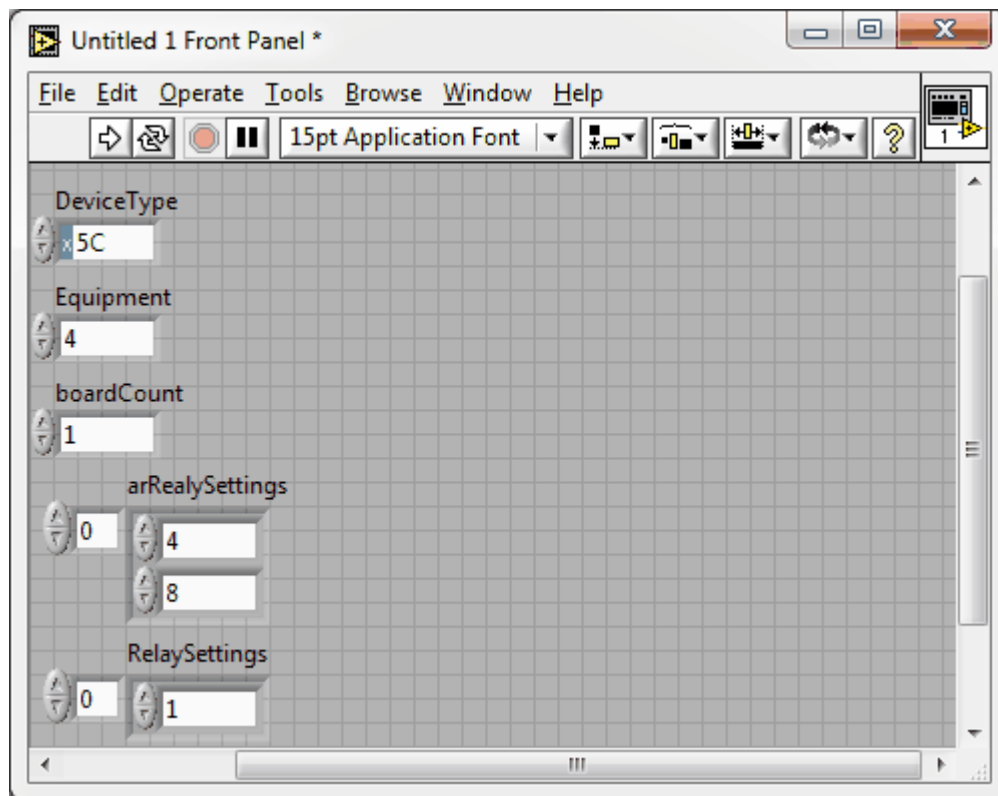
5.1.2 One module using expansion relais EXT-MC1-K1

For making a resistance mearurement between Channel 3 and Channnel 4 you must use the relais according to the following table abstract:

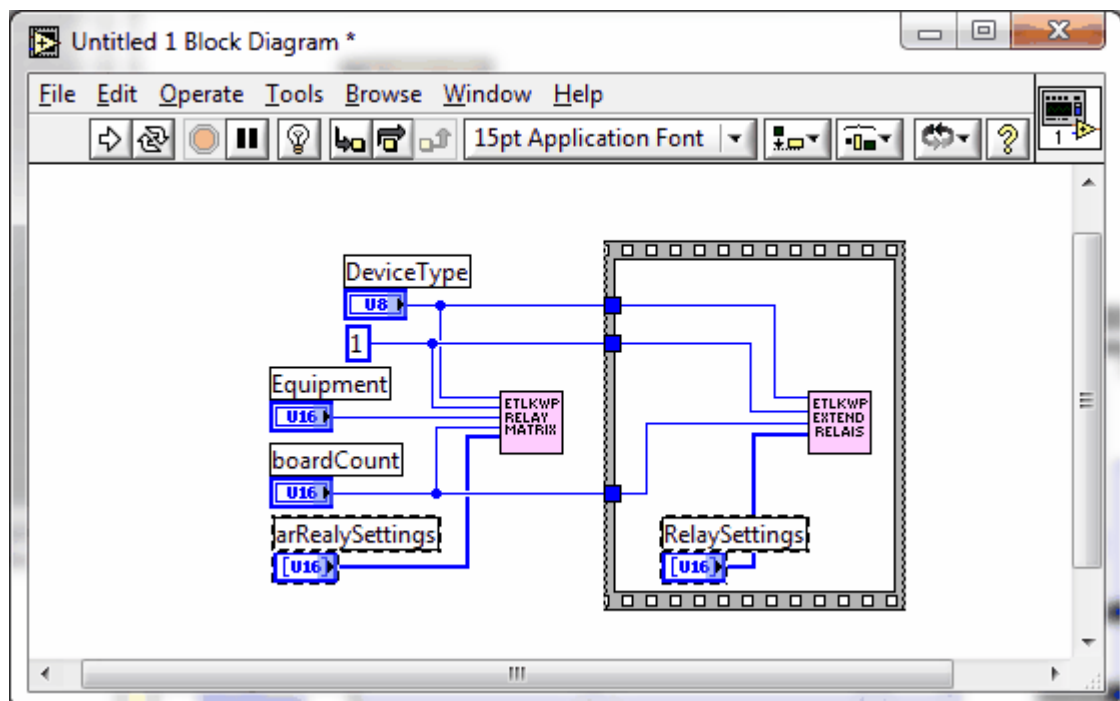
	Output	ATS400	
		HV1/L1	HV1/N
Channel 3 Source	a3	K03	K04
Channel 4 Source	a4	K19	K20

The VI call is as follows:

Front Panel:



Block diagram:



The expansion relays are usually connected to the first module.

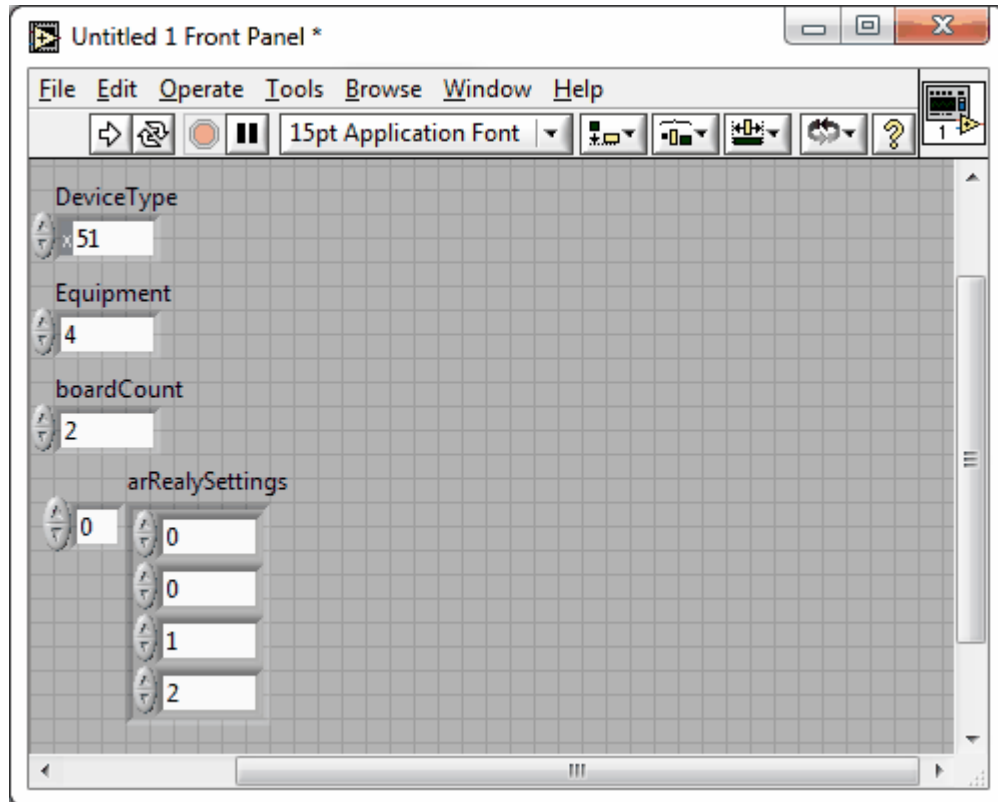
5.1.3 Two modules / no expansion relays

For making a measurement between Channel 17 and Channel 18 on the second module you must use the relays according to the following table abstract:

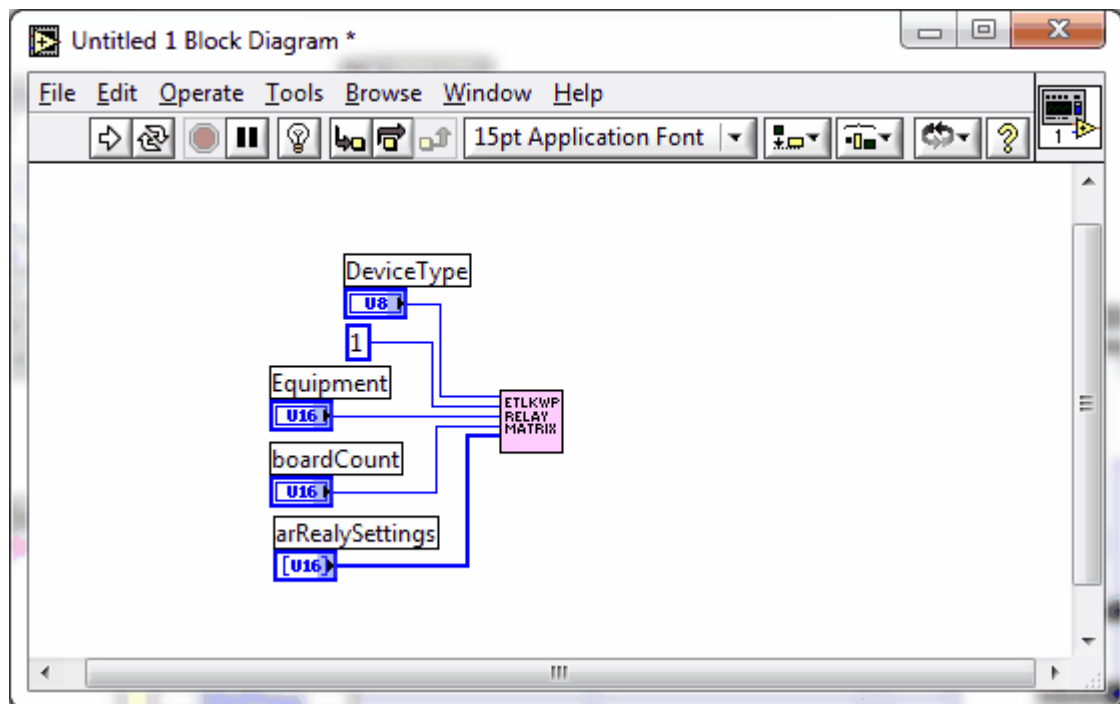
	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 17 Source	a1	K33	K34
Channel 18 Source	a2	K49	K50

The VI call is as follows:

Front Panel:



Block diagram:



The expansion relays are unchanged.

5.2 Using as single command

This is done by calling the `ETLKWPSetMatrixPermanent` VI and the `ETLKWPSetExtendedRelais` if applicable. The example `RelayMatrixPermanent` is a complete example supplied with the driver.

You must supply the relay matrix type, the number of modules, the connection in the matrix, the expansion relay if applicable and start the setting.

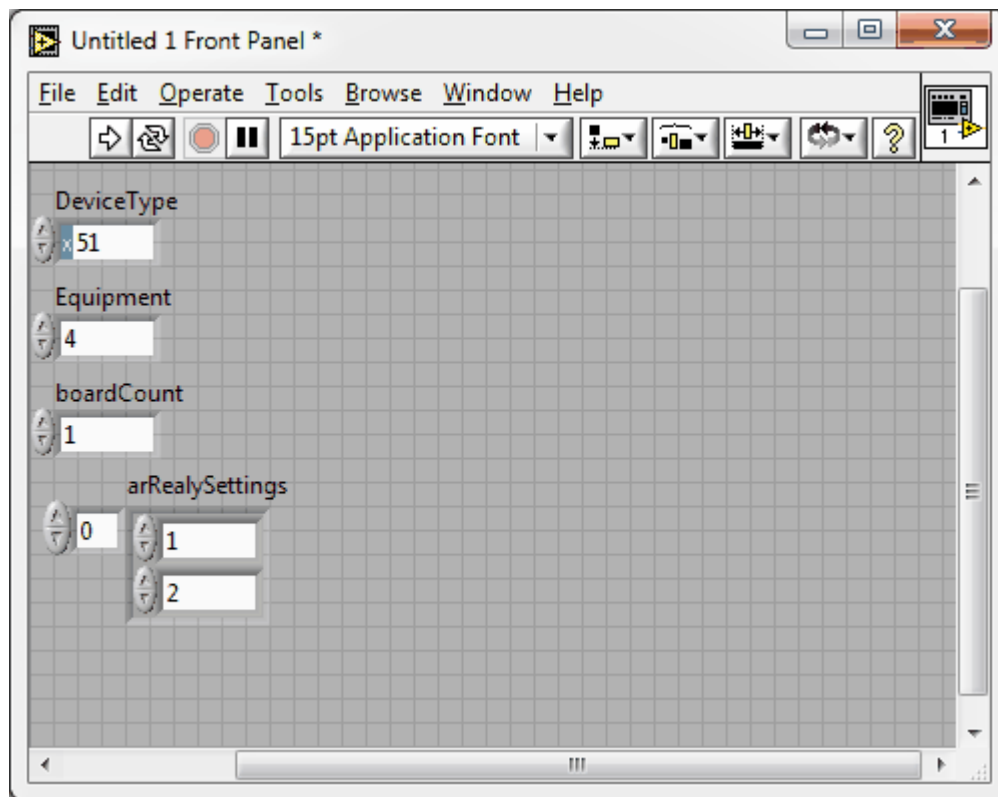
5.2.1 One module / no expansion relays, permanent

For making a measurement between Channel 1 and Channel 2 you must use the relays according to the following table abstract:

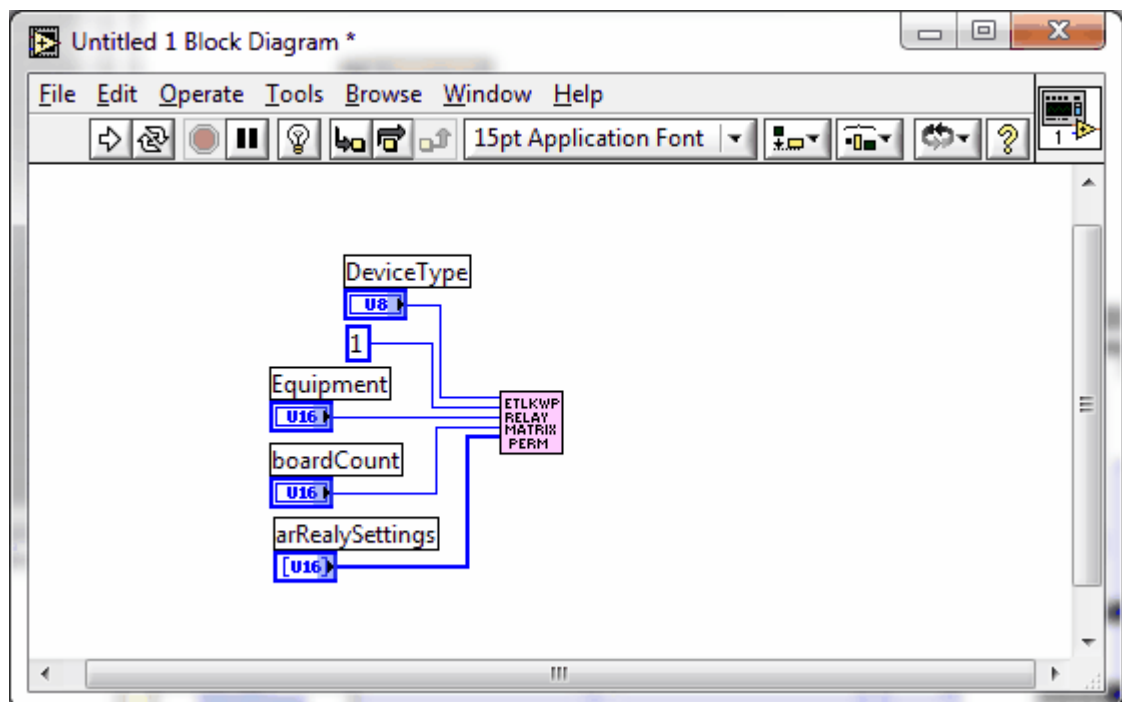
	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

TheVI call is as follows:

Front Panel:



Block diagram:



The expansion relays are unchanged.

6 ASCII commands

Using the ASCII commands you must supply the relay matrix type, the number of modules, the connection in the matrix, the extended relay if applicable and start the setting.

6.1.1 One module / no expansion relais

For making a measurement between Channel 1 and Channel 2 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 1 Source	a1	K01	K02
Channel 2 Source	a2	K17	K18

The command sequence is as follows:

```
RMNB+000001
RMNR+000004
RM00+000001
RM01+000002
RMST
```

The expansion relais are unchanged.

6.1.2 One relay module using expansion relais EXT-MC1-K1

For making a resistance measurement between Channel 3 and Channel 4 you must use the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV1/N
Channel 3 Source	a3	K03	K04
Channel 4 Source	a4	K19	K20

The command sequence is as follows:

```
RMNB+000001
RMNR+000004
RM00+000004
RM01+000008
RM64+000001
RMST
```

The expansion relais are usually connected to the first module.

6.1.3 Two relay modules / no expansion relais

For making a measurement between Channel 17 (Channel 1 / 2. relay module) and Channel 18 (Channel 2 / 2. relay module) you have to set the relay according to the following table abstract:

	Output	ATS400	
	HAN-HV, 18 pole	HV1/L1	HV2/PEX
Channel 17 Source	a1	K33	K34
Channel 18 Source	a2	K49	K50

The command sequence is as follows:

```
RMNB+000002
```

RMNR+000004
RM00+000000
RM01+000000
RM02+000001
RM03+000002
RMST

The expansion relay are unchanged.

7 Personal Notes



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