OPERATING INSTRUCTIONS

IRM 5 MMC

Impulse reflectometer with memory card
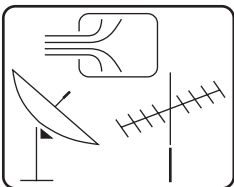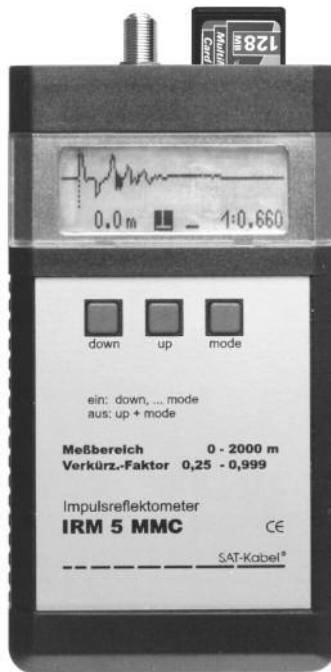
We thank you for buying of a product of the company SAT-Kabel®.
This operating instructions shall help you to understand the functions of the instrument and to ease its use. If you have questions about this instrument or suggestions for further improvements, please get in touch with us.

General

The *IRM 5 MMC* is a impulse reflectometer, processor controlled, with LCD display for check and locate faults in telecommunication and power cables. For a more accurate analysis the return loss of coaxial cables is measured additional. Additional this instrument can store measuring values on a multimedia card. It is handy and easy to operate.

- already 20 cable types are pre-programmed, additional types can be added in the menu
- length measurement at the leading edge of the reflected pulse
- return loss measurement on the reflected pulse
- pulse amplification adjustable at cable bruise, bad connectors and other components with too less return loss.

Delivery volume

  1 *IRM 5 MMC* incl. high-quality NiMH accumulator
  1 plugin charging device AC/AC
  1 operating instructions
  (software: download from *http://www.sat-kabel.de/download.html* or on SAT-Kabel-CD)

  optional available: Imitation leather bag KLT
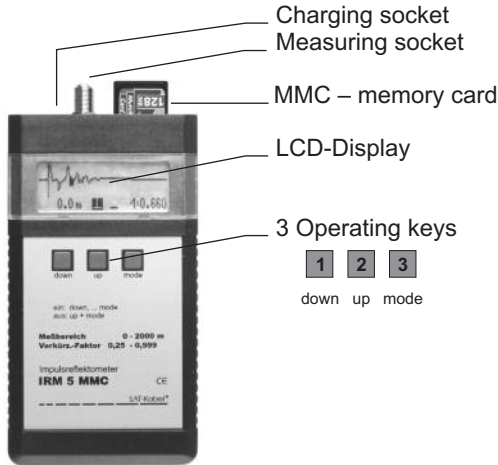 Measuring cable with adapter MKA 150 HQ
  Plastic case

For attention!

- ■ Do not measure at live objects >65V AC !
- ■ Do not expose incident solar radiation, heath and extreme coldness!
- ■ The working temperature range is 0 °C until +40 °C
- ■ avoid shocks by bumps or falling down. We recommend the use of the imitation leather bag.
- ■ The F-measuring socket is a high-quality component. This one is designed for a maximum diameter of 1.1 mm of the inner conductor. We recommend for a good care of the socket to use a measuring cable with F-connector plus an according adapter.

Charging:
Connect the plugin charging device (containing in the delivery volume) to the charging socket of the IRM 5 (ø5.5/2.1 mm, plus pole inside). The power supply voltage (11...28 V) and charging control is shown on the display.

Operational elements

Charging socket
Measuring socket
MMC – memory card
LCD-Display
3 Operating keys

1	2	3
down	up	mode

Meßbereich   0 - 2000 m
Verkürz.-Faktor 0,25 - 0,999

Impulsreflektometer
IRM 5 MMC   CE

SAT-Kabel®

Technical data, features

Measuring ranges	0 – 2000 m
Resolution	0,25 m / 1 m / 4 m switchable
Accuracy	0,2 % of the measuring range
Propagation factor	0,250 – 0,999
Storage places	30 for cable type and propagation factor already 20 pre-programmed
Dynamic	44 dB
Sensitivity	70 dB
Digital filter	switchable for suppression of External voltages on the cable
Impedance	75 Ohm
Output	F-socket
Output pulse	4 V / 5 ns, 20 ns oder 100 ns wide
Display	LCD 120 × 32 pixel, illuminated
Operation	with 3 keys
Power supply	NiMH-accumulator 6V/750 mAh; AC/AC adapter
Powwer consumption	80 mA
Dimensions/weight	157 × 84 × 30 [mm] / 300 g

Operating functions standard

Function	**operated from:**		
Switch on	key 1 after that key 2 or key 3 (according of the desired mode)		
Switch off	keys 2 und 3 simultaneously		
Cursor move	key 1 "down"		– one step to left
	key 2 "up"		– one step to right
Menu	key 3 "mode"	long(**L**)	– one menu point forward
	key 3 "mode"	shortly(**K**)	– one menu point back

<u>Operating:</u>

Keys:"*down*" = 1; "*up*" = 2; "*mode*" = 3

Switch on: push key 1, after that push key 3. (accumulator full app. 7 V, empty app. 5.5V)

Switch off: push simultaneously key 2 and 3, after 4 min. inactivity automatically.
            If the accumulator voltage drops to 5.9 V, a fade-in happens on the display.
            At 5.5 V the IRM switches off itself.

Use of the given cable types:
      Switch on the *IRM 5 MMC* with key 1 , push after that key 2. Select the cable type with the keys 1 und 2 , after that push key 3 – propagation factor and cable attenuation of the cable types are preset at the measurements.

Cursor movement:
      With key 1 or 2

Fast Cursor movement:
      Keep pushed key 1 or 2 .

Choice between length measurement and return loss:
      Push shortly key 3 .

**Fault location: ATTENTION ! Do not measure on live cables !
(Electric strength max. 65 V)**

   At 0 m the positive transmitting pulse can be seen. If the connected cable is open on its end, an additional positive going pulse appears on the display. In the case of a shorted end of the cable a negative going pulse appears reflected from the cable end (pulse echo). Adjust the cursor to the beginning of the pulse and read the cable length. If the cable is terminated with a resistance equal to the impedance of the cable, no reflexion occurs when the cable is faultless. In the case of breaks, contact faults in sleeves, short circuits or taps/splitter in the sector to be tested, the distance to the cable beginning can be determined by the pulse echo.
   If wide pulses are used for the measurement, the echoes are stronger, but faultless taps/splitter cause then strong echoes.

Selection of resolution, output pulse width, storage place or propagation factor:
      Outgoing from the length measurement: push long key 3 until the desired symbol appears inversely.
      change of the selected value with the keys 1 and 2.
      Permanent storage: push keys 1 and 3 simultaneously.
      Back: push short key 3 .

Measuring of the return loss (reflexion attenuation dBRL) :

Set cursor to pulse peak and read return loss on the left bottom corner.
The cable attenuation/100m at 50 MHz is displayed on the right bottom corner and has to be set on a value according the data sheet of the cable. (selection possible by pushing long key 3).
If the cable attenuation is correctly set, the *IRM 5 MMC* displays the real return loss (local return loss). The pulse attenuation of the cable is taken into consideration by the *IRM 5 MMC*, the pulse gain is set automatically.
For measurement of the return loss a pulse width of 20 ns (middle pulse) is best suitable.

Measurement of the cable attenuation/100m at 50 MHz:

Connect app. 100 - 200m cable on the *IRM 5 MMC*, shorted or open end (all pulse energy will bereflected). Select pulse width 20 ns. Set cursor on the pulse echo. Set the value of the cable attenuation so that the return loss will be 0 dBRL. Read the attenuation value.

Digital filter:

To reject or decrease interference voltage on the cable, which affect the displayed waveform, a digital mean filter "Fi" can be connected. The display of the waveform will be delayed to 3 seconds.

Pulse amplifier

Between the storage places 0 and 9 for different cable attenuations on the storage place "V" the gain of the pulse amplifier can be firmly set from 0 to 28 dB in steps of 4 dB to increase the sensitivity of the *IIRM 5 MMC* at short cable length (10 – 100 m).
If at the measurement of the return loss the gain is firmly set, the displayed value contains the cable attenuation, i.e. the displayed dBRL value consist of the sum of the local return loss and the cable attenuation.

Moving of the zero line:

The amplitude on the cursor position can be set to the zero line by pushing the keys 1 and 2 simultaneously. Because the *IRM 5 MMC* has its highest sensitivity in the area of the zero line, e.g. the graphical representation of the amplitude on the pulse peak can be seen.
This function can be cancelled by pushing the key 3.

Start mode:

If at a certain resolution the keys 1 und 3 are pushed simultaneously, this resolution will be active at the switch on of the *IRM 5 MMC*.

Propagation factors:

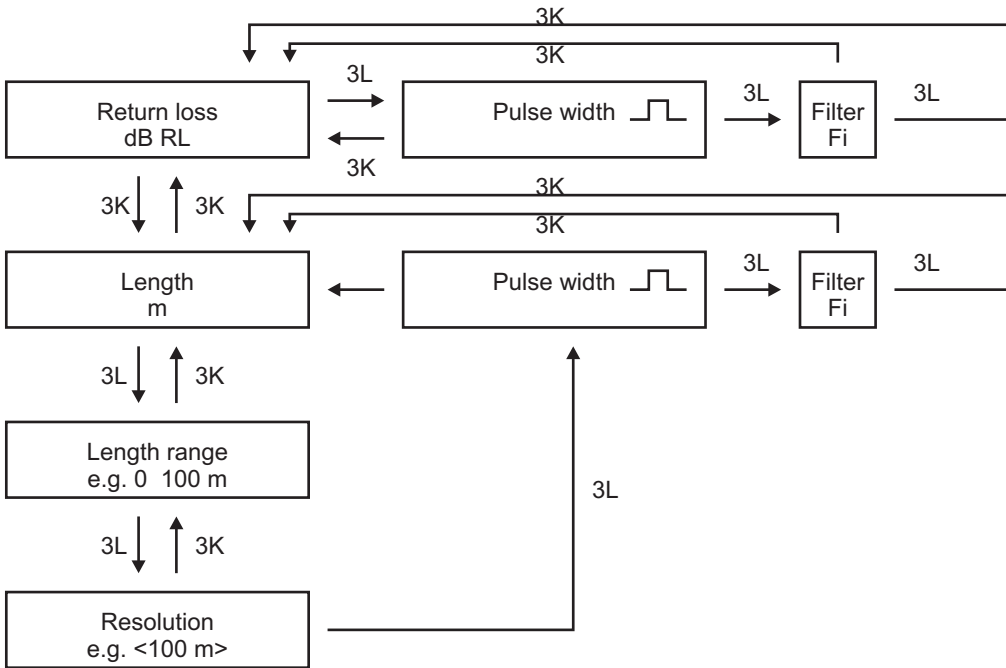|		
Power cables	0.49 0.57, (app. 0.53)	
Coaxial cable with PE dielectric	0.66	
Coaxial cable with foam-PE	0.77 0.85	
Air isolation	0.88 0.92	

Operating scheme IRM 5 MMC

Switch on :
Switch on with selection of the cable type:
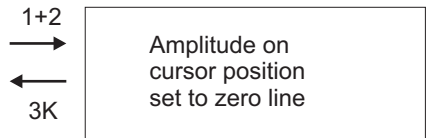Cursor shift or change values:
Store values: push

Keys: "*down*" = 1; "*up*" = 2; "*mode*" = 3
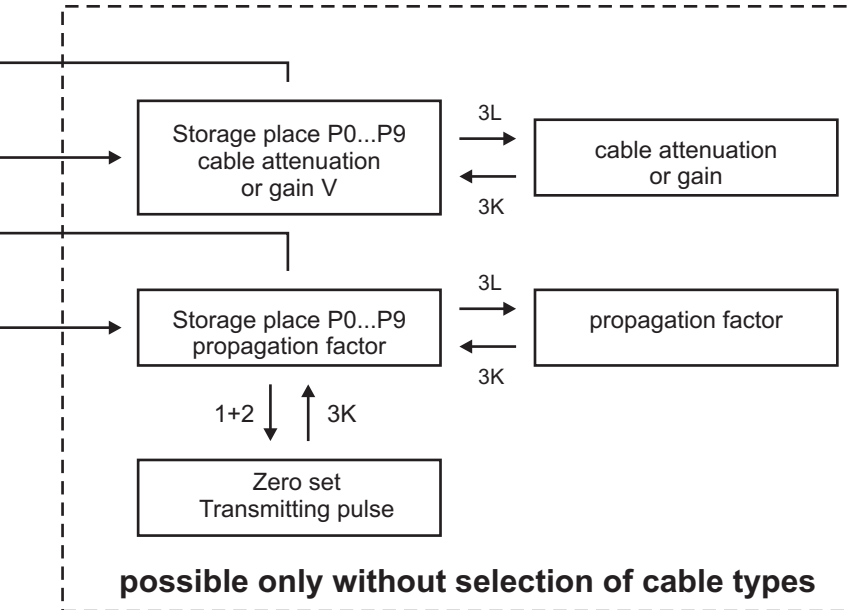
K = push shortly
L = push long

	3K	
	3K	

```
                           3K
        ┌──────────────────────────────────────────────┐
        │   ┌──────────────────────────────┐            │
        ▼   ▼              3K               │            │

  ┌──────────────┐    3L   ┌──────────────┐   3L  ┌────────┐  3L
  │ Return loss  │ ──────► │ Pulse width ⎍│ ────► │ Filter │ ────►
  │   dB RL      │ ◄────── │              │       │   Fi   │
  └──────────────┘    3K   └──────────────┘       └────────┘

   3K│  ▲3K            3K
     ▼  │    ┌──────────────────────────────────────────┐
          ┌──────────────────────────────┐  3K          │
          ▼  ▼                            │              │
  ┌──────────────┐        ┌──────────────┐   3L  ┌────────┐  3L
  │   Length     │ ◄───── │ Pulse width ⎍│ ────► │ Filter │ ────►
  │      m       │        │              │       │   Fi   │
  └──────────────┘        └──────────────┘       └────────┘

   3L│  ▲3K
     ▼  │
  ┌──────────────┐
  │ Length range │                     3L
  │ e.g. 0  100 m│
  └──────────────┘

   3L│  ▲3K
     ▼  │
  ┌──────────────┐
  │ Resolution   │ ────────────────────┘
  │ e.g. <100 m> │
  └──────────────┘
```

in all settings:

1+2	
──────►	Amplitude on cursor position set to zero line
◄──────	
3K	

(ohne Messwertspeicherung)

```
Key 1, then key 3
Key 1, then 2 / cable type select with 1 and 2 / push 3
with 1 or 2
1 + 3 simultaneously
```

	3L	
Storage place P0...P9 cable attenuation or gain V	→ ←	cable attenuation or gain
	3K	

	3L	
Storage place P0...P9 propagation factor	→ ←	propagation factor
	3K	

1+2 ↓ ↑ 3K

Zero set
Transmitting pulse

possible only without selection of cable types

Change of the stored cable types:
- IRM 5 switch off,
- 1 + 2 push 5 s long up to cable memory appears.
- Select value with 3 K and change it with 1 and 2.
- Store it with 1 + 3.

Measuring of the propagation factor (nvp-value) of the cable:
   Connect a cable with known length (e.g. 100 m) on the IRM 5. Set the cursor on the cable length
   and change the propagation factor so that the pulse echo appears behind the cursor.

Measurement principle:
   The measuring pulse fed into the cable will reflected by inhomogeneity of the cable i
   mpedance (cable faults) and showed on the display.
   The distance and the kind of the fault can be determined out of the shape and the time setting
   of the reflection. (Practical experience can be obtained by test measurements).

Propagation factor:
   The Propagation factor (v/c or pulse velocity) declares the velocity of electrical signals in the
   cable in relation to the speed of light.

   The propagation factor of the cable under test must always preset before the length
   measurement.
   If the propagation factor is unknown, a approximate value is set and the fault is determined from
   both ends of the cable

Zero adjustment of the transmitting pulse:
-   Select a storage place of the propagation factor
-   push key 1 and 2 simultaneously up to " $\leftarrow \sqcap \rightarrow$ " appears on the display.
-   Shift the transmitting pulse with key 1 or 2 so that the cursor is located at beginning
    of the pulse.
-   Store this setting by pushing the keys 1 und 3 simultaneously.
-    Back to the normal operation with key 3.

Change of the cable characteristic values:
   1. In switched off condition push the keys 1 and 2 simultaneously so long, until
      the display of the storage places appears.

0.80 / 3.50	CPE
ON	
P: 1 v/c=0.83	5.7 dB

   2. Select by shortly pushing of the key 3 the parameter to be changed (inverse
      display) and change with the keys 1 and 2.
   3. Not used storage places can be faded in or out with the parameter "ON" resp. "OFF".
      Faded out storage places don't appear any more at the switch on.

   The changeable parameters are:
0.08	inner diameter
3.5	outer diameter
CPE	dielectric
ON(OFF)	fade in/out of the storage place
P: 1	storage place (e.g. 1)
v/c	propagation factor
5.7 dB	cable attenuation

   4. Storage by simultaneously pushing of the keys 1 and 3.

Storage of data on the MMC card:
1. Switch on the instrument with the key 1 and after that with key 3 or over the cable selection with the key 1 and after that with key 2.
2. For storage must be inserted a MMC card in the IRM 5 MMC.
   Push the keys 1 and 3 so long, until e.g. the following appears on the display:

```
T3L:    BACK           START
LAENGE:  100 m
IMPULS:  _| |_
FILTER:    ____        v/c=0.780
```

   The displayed values are adopted from the previous settings and can now be changed.
4. Select the parameters to be changed by shortly pushing of the key 3 (inverse display) and change with the keys 1 and 2.
   - Is "BACK" marked, you come by long pushing of the key 3 in the previous menu point
5. If "START" is marked, the storage process will be triggered by long pushing of the key 3. In this case the IRM 5 MMC picks up measuring data and stored these on the multi media card. On the display appears the following notice:

```
MESSPUNKTNAME
IRM5-MESSUNG 0001
100m
SCAN ERFOLGREICH !
```

6. If "SCAN ERFOLGREICH !" in the last line of the displays appears, the measurement is successfully completed. The measurement point name is automatically consecutively numbered.
7. By shortly pushing of the key 3 the IRM 5 MMC will be reset in the normal operation mode.

PC software

The necessary software for the use of the multi media card and an installation instruction you can find in the actual version in Internet under *http://www.sat-kabel.de/download.html* for the corresponding measuring instrument in a free download. In order to use this software, on the used Win-PC must be installed the Java Runtime Environment (JRE) in the version 1.5.0 – also called as version 5. If necessary this software can be free downloaded from the Internet e.g. under *http://www.java.com*.

ATTENTION!
The MMC card has to be formatted only with FAT (FAT 12 or FAT 16). They don't be formatted in no case with FAT32 or even NTFS!

IRM 5

Stored cable data

Program place	cable type designation	cable diameter inner conductor	cable diameter dielectric	kind of dielectric	propagation factor	cable attenuation at 50 MHz at 100 m
P 1	CCS 36 GAS	0,41 mm	1,90 mm	CPE	0,78	10,9 dB
P 2	MIDI EXTRA 65 GAS	0,65 mm	3,00 mm	CPE	0,83	7,2 dB
P 3	COAX 12	0,70 mm	4,60 mm	PF	0,66	5,6 dB
P 4	EXTRA 80 GAS	0,80 mm	3,50 mm	CPF	0,83	5,7 dB
P 5	H 126 DUOBOND PLUS	1,00 mm	4,60 mm	CPE	0,82	4,5 dB
P 6	TRISHIELD DIGITAL GAS	1,02 mm	4,40 mm	CPE	0,85	4,3 dB
P 7	QUADRISHIELD DIGITAL GAS	1,02 mm	4,40 mm	CPE	0,85	4,2 dB
P 8	TELASS B1,1/7,3	1,10 mm	7,25 mm	PE	0,66	3,8 dB
P 9	1 ikx 1,1/7,3	1,10 mm	7,30 mm	PE	0,66	3,3 dB
P 10	AMEL SAT GAS, SAT 300 GAS	1,13 mm	4,80 mm	CPE	0,85	4,1 dB
P 11	ALM DIGITAL SAT/ GAS	1,13 mm	4,80 mm	CPE	0,85	3,9 dB
P 12	PA 1,63/50 SAT GAS	1,63 mm	7,20 mm	CPE	0,84	3,0 dB
P 13	PA 1,63 ALL DIGITAL- SAT (AP/Tragseil)	1,63 mm	7,20 mm	CPE	0,84	2,7 dB
P 14	COAX 6 (LG)	1,70 mm	6,95 mm	CPE	0,89	2,3 dB
P 15	1nkx	2,20 mm	8,80 mm	PEH	0,88	1,8 dB
P 16	1qkx	3,30 mm	13,50 mm	PEH	0,88	1,2 dB
P 17	75-7-12 D	2,60 mm	10,00 mm	AIR	0,85	1,6 dB
P 18	75-7-16 D	3,80 mm	13,80 mm	AIR	0,92	1,1 dB
P 19	1skx	4,90 mm	19,40 mm	PEH	0,88	0,9 dB
P 20	75-7-G	1,20 mm	8,00 mm	PE	0,67	4,0 dB

Cleaning and maintenance

The surface of the housing can be cleaned with a dry, soft and lintfree cloth. Do not use aggressive solvents for the cleaning.

This operating instruction has been drown up to the best of our knowledge. Errors, technical amendmends and developments are subject to change without notice!
Updated operating instructions in PDF form can be also downloaded from our internet homepage. (***www.sat-kabel.de***)

Guarantee
State July 2006

For this instrument will be granted a service life (in following called guarantee) to following conditions:

- ■ This guarantee is valid for new instruments purchased in Germany.
- ■ New instruments and their components, which are defective because of production faults and/or material faults, are repaired or are replaced from SAT-Kabel® against a corresponding instrument.
- ■ For wear parts, like accumulators, keyboards, housings, bags, connecting cables this guarantee is valid for 6 month from the purchasing date.
- ■ The guarantee claim expires at matings by the purchaser or third persons.
- ■ At defects, caused by improper handling or operating, by wrong installation or store, by improper connection or mounting, no guarantee is granted .
- ■ For not justified demand of our service we charge for our service the usual payment for material, working hours and forwarding costs.
- ■ Repairs are only made with filled service covering.

(Forms for service coverings and further information are found in the standard form contracts under:
 www.sat-kabel.de)