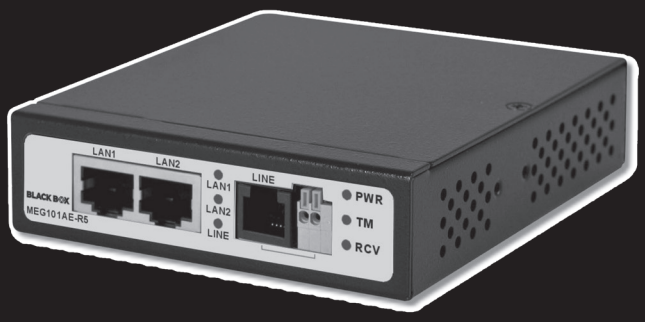
USER MANUAL

MEG101AE-R5

VDSL2 MINI MODEM

24/7 TECHNICAL SUPPORT AT 1.877.877.2269 OR VISIT BLACKBOX.COM



BLACK BOX®

Dear customer,

Thanks for purchasing MEG101AE-R5, the new release of our successful MEG101 series. Note that Release 5 is different from previous releases. It is not compatible with older releases, and it not to be used with the older MEG801 series aggregation switches.

Our years of experience in xDSL technology made this product better and more intuitive then other previous xDSL devices from Black Box. The DIP switches are described in an easier-to-understand manner. The maximum bandwidth is now 100Mbps while the latency is lower.

The product has changed over time. Release 5 does not have the telephony port for transmitting analogue telephony in parallel. Instead, there are now two LAN Ports.

If you wish to transmit analogue telephony (or S2M/E1 or ISDN), contact Black Box support. There are ways and devices available to transmit any telephony connection on a working, low latency, Ethernet Network connection.

Contact your nearest Black Box office if you have any product questions. Visit www.black-box.eu for a list of countries, offices, phone numbers, and addresses.

Black Box Worldwide Offices

As well as the Black Box International Subsidiaries listed below, we also have a worldwide network of distributors ensuring efficient shipment of stock and delivery of the right local technical and language support that you need.

Australia	España	Österreich
Belgium + Luxemburg	France	Puerto Rico
Brasil	Italia	Suomi
Canada	Japan	Sverige
Chile	México	Schweiz
Danmark	Nederland	United Kingdom
Deutschland	Norge	United States of America

Warranty

MEG101AE-R5 is sold with a standard 12-month warranty unless your local dealer or Black Box office agreed to a longer warranty period.

The warranty does not include:

- Using any power supplies other than the one(s) included with your product
- Opening the device
- Changing the device
- Placing screws or nails within or through the device
- Damages caused by surge or overpower
- Damages caused by heat, water, or direct sunshine

If you experience any error or problem, contact your local dealer or nearest Black Box office for support. If you are told to send the device for RMA and repair, ALWAYS ship the entire device, including its power supply.

The spare power supply for MEG101AE-R5 is Black Box Part number KVT127E-PS-R2.

Safety warnings

- DO NOT open the device. Opening or removing covers can expose you to dangerous high voltage points or other risks.
- Only allow qualified service personnel to service the device.
- Place connecting cables carefully so that no one will step on them or stumble over them. DO NOT allow anything to rest on the power cord, and do NOT locate the product where anyone can walk on the power cord.
- DO NOT install or use your device during a thunderstorm. There may be a remote risk of electric shock from lightning.
- DO NOT expose your device to dampness, dust, or corrosive liquids.
- DO NOT use this product near water, for example, in a wet basement or near a swimming pool.
- DO NOT obstruct the device’s ventilation slots or staple the units, since insufficient air flow may harm your device.
- DO NOT place items on the device.
- DO NOT use the device for outdoor applications, and verify that all connections are indoors or have waterproof protection.
- Keep the device and all its parts and accessories out of reach of children.
- Clean the device using a soft and dry cloth rather than liquid or atomizers. Power off the equipment before cleaning it.

MEG101AE-R5 Setup Steps

MEG101AE-R5 is a point-to-point, Ethernet bridge using simple telephony wires as a media. MEG101AE-R5 offers you two LAN 10/100/1000 Mbps ports. Therefore, MEG101AE-R5 is a fully switched L2 device.

To get started, unpack the device. Only use the included power supply. Do not mix this power supply with power supplies from older MEG101 releases.

After unpacking:

1. Configure one device to be installed on side A to be the Transmitter (TM). Set DIP Switch #1 (Mode) to OFF.
2. Configure one device to be installed on side B to be the Receiver (RCV). Set DIP Switch #1 (Mode) to ON.
3. Leave the other DIP Switches #2 to #4 in factory default (OFF-OFF-OFF).
4. Route your two wires to the LINE Port by either using the RJ-11 (middle pins) or the terminal block.
5. Connect the power supplies and wait for the LINE LED to light up.

Troubleshooting:

1. If the line is unstable (LINE LED is on for some minutes, then again off for some seconds, then again on, etc.), change DIP Switch #3 (SNRM) to ON. Then reboot both units.
2. If you experience Network dropouts, change DIP Switch #4 (Interleave) to ON. Then reboot both units.
3. If you experience interferences or bad audio quality on nearby telephony transmissions, change DIP Switch #2 (Band) to ON. Then reboot both units.

The maximum bandwidth of MEG101AE-R5 is 100Mbps symmetrical up to a cable 300-400m. The exact number of meters depends on various factors, including your wire diameter, quality, and number of interconnects.

The maximum cable length of MEG101AE-R5 is up to 3000m with quality thick cables. For longer cables (>300-400m), the bandwidth is lower and asymmetrical. Review the performance/reach table later in this manual.

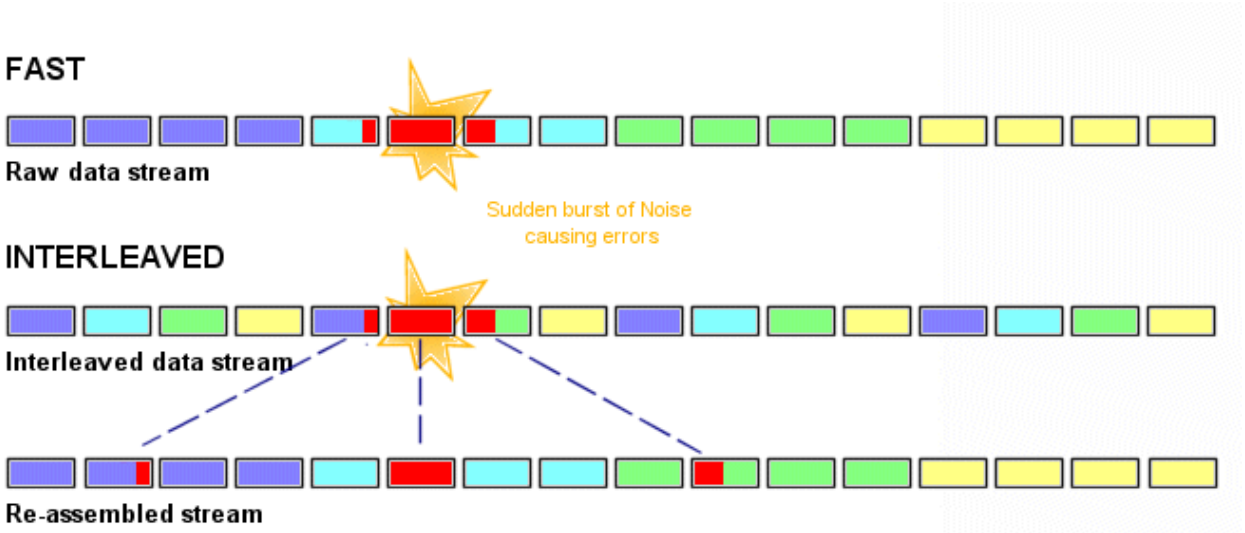
CAUTION: Avoid using telephony RJ-11 ribbon cables. These cables are built with very low diameter stranded cables. Using them will cause lower bandwidth and shorter reach.

What does Interleave mean?

This feature is used to protect the transmission and the stability of the connection against crosstalk issues. Crosstalk comes from signals on other cables. With the Interleave feature your connection and transmission will be more reliable.

Without Interleave you may lose some data through noise caused by crosstalk. This leads to a rerequest of data, which slows down your overall bit rate and net bandwidth. With many lost data packets you may also lose synchronization between transmitter and receiver.

Interleaving is a method of taking data packets, chopping them up into smaller bits, and then rearranging them so that once contiguous data is row spaced further apart into a non-contiguous stream. Data packets are reassembled into the right order of data by the receiver.



If your line is particularly susceptible to bursts of noise, then interleaving should improve your VDSL experience. Noise on the line caused by crosstalk will not damage a complete block of data, but parts of data blocks, which can be reassembled by CRC.

NOTE: Higher interleave means higher latency.

What does SNRM mean?

SNRM is the Signal to Noise ratio. Any xDSL device puts a signal on a cable which degrades with every meter and kilometer of cable. The degradation comes from noise produced by other signals on nearby cables, by high power devices (such as elevators), by smartphones (EMI), and by other wireless devices.

At the end the signal of the xDSL device has a certain strength in comparison to the noise. You can compare this with two people in an empty room talking (no noise) or two people talking in a crowded room (high noise).

Many xDSL devices automatically adjust bandwidth and modulation. The better the signal in comparison to the noise comes through, the higher the bandwidth can be.

Setting the MEG101AE-R5 to a higher SNRM of 9db means that the modem will synchronize the line with a spare of 9db budget. If you experience high EMI at your installation, a higher spare budget means more stability but less bandwidth.

What does G.INP mean?

All DSL lines suffer at various degrees from noise bursts. This interference may come from electric storms, power supplies, radio transmissions, or just general background electrical interference. This noise can drown out the signal which is used to transmit your broadband data. If the noise is stronger than the signal, then data packets are lost, which can cause slow page loading, interrupt video streams, etc.

G.INP is an Error Protection method which helps to prevent the loss of data in the event of noise bursts by using a retransmission buffer at the physical layer (in the Modem/Router/CO side). G.INP retransmission works in a similar way to TCP retransmission.

Notable differences between G.INP and TCP:

- TCP/IP is a software suite of protocols between two end-to-end points. For example, web browsers, such as Edge and Chrome, use the TCP/IP protocol HTTP to establish a connection between a PC and a remote web server. If data isn't received or is corrupt, then the web browser will attempt to rerequest the data direct from the server.
- G.INP is a software construct carried out at the physical layer. For example, data sent from the CO side is wrapped in a special packet (DTU). The router will check that data isn't corrupt and then either forward the data onwards to our PC, or, if corrupt, rerequest the data from the CO side. The transmitting end needs to retain a temporary buffer to store data in case data needs to be retransmitted.

Although G.INP as an invention has existed for several years and it is a software construct (for example, firmware), many Telco companies delayed rollout since it relies on hardware resources to process the DTU and store data in the retransmission buffer at the transmitting end.

Since the CO side will be doing ReTX buffering in the downstream direction and will have many users on each line card in the CO side, downstream retransmission will require significant hardware resources on the CO side.

What else is available?

There is also an industrial version MEG250AE-R2 available. MEG250AE-R2 has an IP30 chassis, 4 LAN Ports 10/100/1000, and an extended temperature range. MEG250AE-R2 is for DIN-Rail mounting and for DC powering from 15 to 48V DC. MEG250AE-R2 also has an alarm relay contact.

Installing the Modem MEG101AE-R5
Hardware Installation

MEG101AE-R5 can be used for any indoor, dry, and well temperature environment. Do not exceed the temperature range. Stapling the MEG101AE-R5 is not permitted.

The Modem should be located in a cool and dry place with at least 10 cm (4”) of space at the front and back for ventilation.

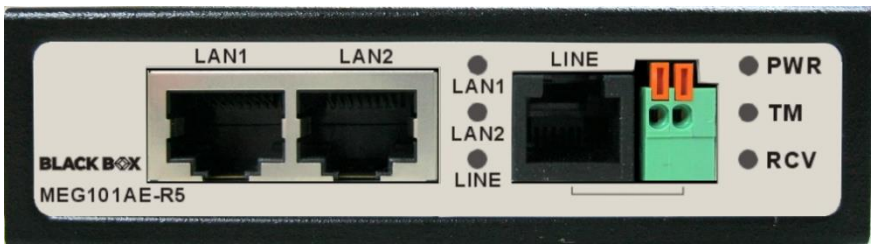
Place the Modem out of direct sunlight and away from heat sources or areas with a high amount of electromagnetic interference.

Check if network cables and connectors needed for installation are available.

Do not use any telephony ribbon cables.

Do not use any low diameter cables. At least AWG26 is recommended, and AWG24 is better.

MEG101AE-R5 is not capable of doing PoE PSE or PD. You may connect PoE devices, but they will not be powered.



Read page 4 for setup steps.

Front Panel Description:

The front panel shows from left to right:

LAN1/LAN2 Port	Network Ports 10/100/1000Mbps, RJ-45, Auto-negotiation
LAN1/LAN2 LED	Off if no link, On if link and flashing while transferring data
LINE LED	Off if no link, On if linked, flashing slowly if just synchronizing, flashing fast if transferring data.
LINE Port or	2 Wire VDSL2 Connection. Use either RJ-11 (middle pins)
	Terminal Block, never both. You can use RJ-11 on Transmitter and Terminal Block on Receiver side
PWR LED	Off if unpowered, On if powered
TM LED	On if running in Transmitter mode
RCV LED	On if running in Receiver mode

Rear Panel Description:

The rear panel shows from left to right:

Ground Clip — Connect to ground/earth. The surge protection inside MEG101AE-R5 can only work with a proper ground connection on both sides.

DIP Switches

DIP Switch on rear panel				Config Mode	Description
PIN1	PIN2	PIN3	PIN4		
OFF	OFF	OFF	OFF	Sy-Auto I_8/2 (SNRM 8/8)	Symmetric Auto, Max. Interleave=8, Min.Inp=2,SNRM=8 (Default)
OFF	ON	OFF	OFF	NSy-Auto I_8/2 (SNRM 8/8)	non symmetric Auto, Max. Interleave=8, Min.Inp=2, SNRM=8
OFF	OFF	ON	OFF	Sy-Auto I_8/2 (SNRM 6/6)	Symmetric Auto, Max. Interleave=8, Min.Inp=2,SNRM=6
OFF	ON	ON	OFF	NSy-Auto I_8/2 (SNRM 6/6)	Non symmetric Auto, Max. Interleave=8, Min.Inp=2,SNRM=6
OFF	OFF	OFF	ON	Sy-Auto G.INP_17/2/41 (SNRM 12/12)	Symmetric Auto, enable G.INP, enable retransmition, SNRM=12
OFF	ON	OFF	ON	NSy-Auto G.INP_17/2/41 (SNRM 12/12)	non symmetric Auto, enable G.INP, enable retransmition, SNRM=12
OFF	OFF	ON	ON	Sy-30a-D2.2M G.INP_17/2/41 (Rate 20/20) (SNRM 24/24)	Symmetric 30a, disable 0~2.2MHz, enable G.INP, enable retransmition, Max.Line rate=20Mbps, SNRM=24
OFF	ON	ON	ON	Annex-A-17a-eu32_I-8/2 (SNRM 6/6)	17A Annex A Eu32, Max. Interleave=8, Min. Inp=2,SNRM=6
ON	NA	NA	NA	RCV Mode	Switching to Receiver mode

Power — For use with included original power supply.
12VDC/1A
Spare Power Supply: KVT127E-PS-R2

General Rules

Ethernet Port (RJ-45)

All network connections to the Modem Ethernet port must be made using Category 5, 5e, 6a, or 7. No more than 100 meters of cabling may be used between the HUB or Computer.

Line Port (RJ-11 or Terminal Block)

All connections to the VDSL RJ-11 Port or terminal block must use 24~26 Gauge phone wiring. We do not recommend using 28 Gauge or above phone line. The active pins are the two middle pins (2 and 3). To have a clear setup, we recommend having the VDSL line 1:1 straight through. This VDSL device works crossed and straight through.

Line Port RJ-11 Pin out (6 pin wide, 4 pins existing, 2 pins active)

Pin#	FUNCTION
1	Unused
2	**TIP**
3	**RING**
4	Unused

As an alternative to using the RJ-11 port, you can use the Terminal Block. Choose to use either or, but do not use both in parallel. The Terminal Block allows you to use simple wires without crimping a connector to it.

xDSL cabling

No two cables are exactly identical. Physics, including cable length, matters for every cable.

Once you talk to your customer about the cables, you will get an estimation of the necessary cable length. Watch out for interconnects, and ask your customer about them. Every interconnect box influences the main physical factors of the cable:

Impedance and Capacitance

With a good multimeter you should be able to measure the impedance of your cable. The impedance of a telephone wire should be between 50 and 150 Ohm per kilometer. Note that thin cables have high impedance, and thick cables have lower impedance.

Disconnect all equipment on Side A and Side B. Then do a short on Side A of the two wires that you want to use. Next, measure the impedance with a digital multimeter on Side B from wire 1 to wire 2. Divide that value by two to get a rough idea of the cable's impedance. You should also measure the cable's isolation impedance. Therefore, disconnect the short of Side A again and measure from wire 1 to wire 2. The value you get should be several MOhms.

This means, once your customer tells you the route would be 500m long, for example, but your result measuring the impedance is 200 Ohms or more, something is incorrect. Although not science, 200 Ohms is equal to a thick cable of 4 km or a thin cable of 1 km.

If the physics of your cable are within the functional limit of your xDSL device, you get a link. Otherwise, you will not get one. It is all about physics.

Cabling Guidelines and Rules

In general, there are four rules about xDSL cabling:

1. The thicker the cable, the better
2. The weakest part of the cable makes up the quality of the whole
3. Watch out for EMI sources
4. Use twisted cabling

Rule 1 means that using an AWG24 cable is always better than using an AWG28. Watch out for stranded cables. Stranded cables are not as good as solid cables with the same AWG value.

Rule 2 means that one bad interconnect or a few meters of AWG28 cable is significant, even if the rest of the route is thick and good. That is why you should never use telephony ribbon cables to connect the xDSL modem. That is similar to a four-lane highway ending with one lane.

Rule 3: Any device using cables may have issues with EMI and interference. Check the route of the cables. Are they running near an elevator or any other device using high power/amps?

Rule 4: Use twisted cabling if available. Twisted cables are better because, without twisted cables, the crosstalk effect from other cables and signals is remarkable. There are also cables where four wires being twisted together (Quad cabling). Avoid using both cable pairs for the same type of technology.

Compatibility

Which one is compatible with which one?

A MEG101AE
B MEG101AE-R2
C MEG101AE-R3
D MEG101AE-R4
E MEG101AE-R5
F MEG201AE
G MEG201AE-R2
H MEG250AE
I MEG250AE-R2
J MEG801AE
K MEG801AE-R2
L MEG821AE
M MPG101AE-R2

	A	B	C	D	E	F	G	H	I	J	K	L	M
A	Y	N	N	N	N	N	N	Y	N	N	N	N	N
B	N	Y	Y	N	N	N	N	N	Y	N	N	N	N
C	N	Y	Y	N	N	N	N	N	Y	N	N	N	N
D	N	N	N	Y	Y	N	Y	N	N	Y	N	Y	N
E	N	N	N	Y	Y	N	Y	Y	N	N	N	N	N
F	N	N	N	N	N	Y	N	N	N	Y	N	Y	N
G	N	N	N	Y	Y	N	Y	N	N	Y	N	Y	N
H	Y	N	N	N	Y	N	N	N	N	N	N	Y	N
I	N	Y	Y	N	Y	N	N	N	N	N	N	N	N
J	N	N	N	Y	N	Y	Y	N	N	N	N	N	N
K	N	N	N	N	N	N	N	N	N	N	Y	N	N
L	N	N	N	Y	N	Y	Y	Y	N	N	N	N	N
M	N	N	N	N	N	N	N	N	N	N	N	N	Y

You always need matching pairs, meaning one Transmitter and one Receiver. MEG801AE, MEG801AE-R2, and MEG821AE are always functional as a Transmitter.

MEG101AE, MEG101AE-R2, MEG101AE-R3, MEG201AE, MEG201AE-R2, and MPG101AE-R2 are either Transmitter or Receiver and cannot be changed from one to the other.

What can I do if my line is too long?

Often there are different routes to get to the “other side.” Try to find out if there is another one. If not, Black Box has other xDSL devices that will work in your circumstances.

Also check our Etherlink modems. Check www.black-box.eu for product details, features, and more.

Firmware Upgrade

The MEG101AE-R5 units cannot be firmware upgraded. The MEG821AE switches can be firmware upgraded by TFTP or RS-232. Check the switches’ manual for instructions.

Tech Support

If you have any questions, contact Black Box Tech Support. Visit www.black-box.eu for phone numbers of your local office.

Black Box Worldwide Offices

As well as the Black Box International Subsidiaries listed below, we also have a worldwide network of distributors ensuring efficient shipment of stock and delivery of the right local technical and language support that you need.

Australia	España	Österreich
Belgium + Luxemburg	France	Puerto Rico
Brasil	Italia	Suomi
Canada	Japan	Sverige
Chile	México	Schweiz
Danmark	Nederland	United Kingdom
Deutschland	Norge	United States of America

Product Specification

Standard:	IEEE802.3 / IEEE802.3u / IEEE802.3ab standard G993.2 VDSL2 standard
Physical Interface:	(2) RJ-45 10/100/1000Mbps auto-neg. Ethernet port (1) RJ-11/Terminal Block connector for VDSL2 line port (1) DIP Switch (1) Power Jack (1) Grounding Connector
Cable Connections:	RJ-45 (Ethernet): Category 3~7 UTP/STP RJ-11 (VDSL2): Twisted Pair phone wire
LED Indicators:	(1) Power LED (2) Link/Active Status for Ethernet port (1) Link LED for VDSL2 port (1) Transmitter Mode indicator LED (1) Receiver Mode indicator LED
VDSL2 Line Code:	DiscreteMultItone (DMT) modulation
VDSL2Transmission Mode:	Packet Transfer Mode (PTM)
VDSL 2 Chipset:	Metanoia
TypicalPower Consumption:	5 W
Power Requirement:	Input Voltage: 12VDC/1A (Commercial-grade Power Adapter)
EMC:	EMI Compliant: FCC class B EMS Compliant: CE mark
Operating Temperature:	0° ~ 50°C (32° ~ 122°F) Fanless, free air cooling
Storage Temperature:	-20° ~ +70°C (-4° ~+158°F)
Humidity:	10 to 90% (non-condensing)
Weight:	About 0.6 kg
Dimensions:	95 x 110 x 27 mm (3.74" x 4.33" x 1.06”)

Performance / Reach Table

This test was conducted with AWG24 simulation cards, Windows® 7/10/11 machines at 26 degrees Celsius. Simulation cards do not simulate EMI, Interference, and Interconnects. Consequently, your results will vary.

MEG101AE-R5(TM) ->MEG101AE-R5(RCV) Max. Datarate (Down speed/Up speed) Mbps								
Length	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7	Profile 8
100m	147.68/147.68	196.51/93.98	161.01/154.59	213.86/96.40	136.66/134.74	181.45/83.42	18.87/18.87	122.44/49.06
200m	137.80/136.20	185.61/78.35	143.70/140.36	193.99/82.24	115.05/115.41	157.48/64.45	18.87/18.87	116.35/49.06
300m	106.82/121.42	159.35/64.07	121.26/123.14	176.75/68.65	85.36/101.05	138.71/48.93	18.87/18.87	105.83/48.11
400m	80.44/94.22	133.28/42.40	91.02/97.58	146.21/46.07	65.76/70.81	108.30/35.03	18.87/18.87	88.18/43.84
500m	59.05/77.40	99.19/37.82	73.00/77.38	120.22/37.33	50.40/55.40	85.95/27.31	16.92/18.85	77.54/36.95
600m	46.49/58.88	78.46/28.60	51.01/61.08	85.26/32.46	34.81/43.03	59.23/21.57	11.70/11.23	59.82/30.28
800m	19.67/19.29	46.42/10.57	22.47/33.85	46.97/10.55	18.44/20.62	37.64/8.73	x	39.24/16.42
1000m	20.72/14.38	33.27/8.07	20.73/16.96	36.70/8.59	18.98/10.15	25.79/6.09	x	36.21/6.33
1200m	18.46/9.75	23.67/2.97	18.54/10.58	26.87/3.88	13.58/7.37	19.24/2.10	x	25.86/3.63
1400m	12.92/8.01	19.41/2.48	13.42/8.41	21.31/2.52	8.38/5.51	7.78/2.32	x	22.78/1.17
1600m	6.94/7.43	15.08/2.34	8.61/6.58	16.74/2.51	4.66/3.90	4.54/2.10	x	19.47/0.54
1800m	5.60/4.56	11.95/2.06	6.05/5.83	12.60/2.26	4.11/1.99	2.36/1.91	x	15.03/0.52
2000m	4.87/2.72	8.04/1.91	4.87/3.50	9.20/1.15	3.42/0.86	1.13/1.72	x	11.38/0.50
2200m	4.26/0.75	5.89/1.61	4.15/0.98	6.96/1.81	x	x	x	7.95/0.46
2400m	3.66/0.67	4.07/0.33	3.46/1.56	5.00/1.41	x	x	x	6.60/0.39
2600m	3.07/1.18	2.84/0.52	2.79/0.70	3.63/1.16	x	x	x	4.25/0.40
2800m	1.40/0.28	1.75/0.25	2.01/1.10	2.76/1.16	x	x	x	3.01/0.32
3000m	x	1.13/0.12	x	x	x	x	x	1.98/0.20

Remark:

MEG101AE-R5Config Mode	Profile
1. Sy-Auto I_8/2 (SNRM 8/8)	30a/17a Auto
2. NSy-Auto I_8/2 (SNRM 8/8)	30a/17a Auto
3. Sy-Auto I_8/2 (SNRM 6/6)	30a/17a Auto
4. NSy-Auto I_8/2 (SNRM 6/6)	30a/17a Auto
5. Sy-Auto G.inp_17/2/41 (SNRM 12/12)	30a/17a Auto
6. NSy-Auto G.inp_17/2/41 (SNRM 12/12)	30a/17a Auto
7. Sy-30a-D2.2M G.inp_17/2/41 (Rate 20/20) (SNRM 24/24)	30a
8. Annex-A-17a-eu32_I-8/2 (SNRM 6/6)	17a

NEED HELP?
LEAVE THE TECH TO US

LIVE 24/7 TECHNICAL SUPPORT

1.877.877.2269

BLACK BOX®