REA 105
Arc Protection Module

Operator's Manual

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Operator's Manual

Contents:

1. General

REA 105 is an extension unit designed to be used together with the arc protection relay REA 101. The function of the unit is to detect light and to carry out tripping, if the REA 101 unit provides an overcurrent signal at the same time, or delivers a trip command.

The use of extension units allows the protection area to be extended and the protected object to be divided into smaller areas. Thus a more selective system is obtained.

1.1. Features

- Loop-type or radial sensor fibre for arc detection.
- 2 high-speed semi-conductor outputs for tripping.
- Signal relay activated by light detected by the sensor fibre.
- 3 RJ-45 ports for the connection of REA 101 relay and extension units.
- Circuit-breaker failure protection. Delayed light signal to REA 101, which opens the higher-level circuit breaker.
- Self-supervision unit monitoring operating voltages and the sensor fibre loop.

2. Safety

	National and local electrical safety regulations must always be followed.
	Dangerous voltages can occur on the connectors, even though the auxiliary voltage is disconnected.
	The frame of the device has to be carefully earthed.
	Only a competent electrician is allowed to carry out the electrical installation.
	Sensor fibres have to be handled according to the instructions given by the sensor fibre manufacturer.
	Settings and configuration changes have to be done with the auxiliary supply voltage (U_{aux}) disconnected. Malfunction may occur if changes are made with the supply voltage connected.

3. Block diagram

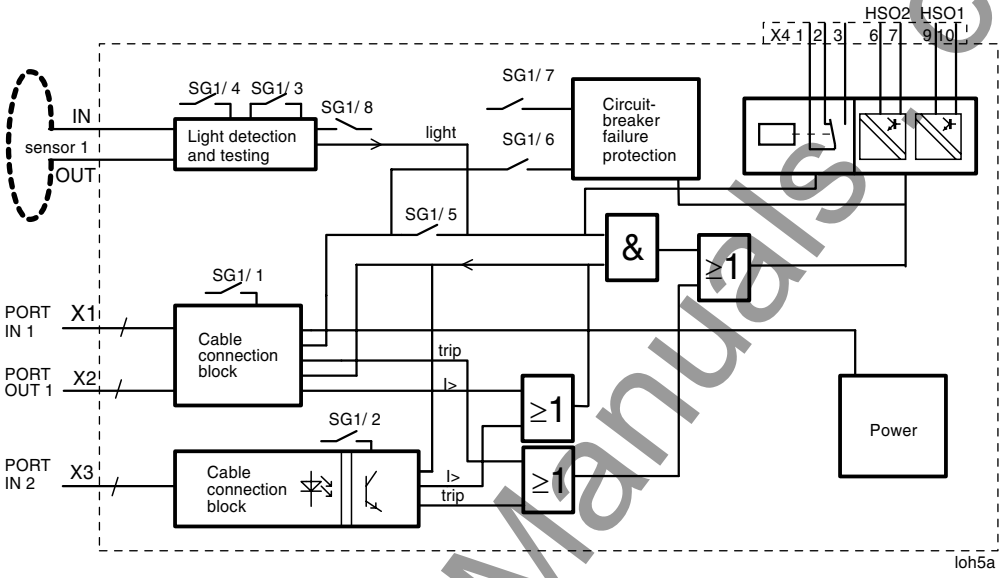

Fig. 3.-1 REA 105 block diagram

4. Description of operation

4.1. Light detection

The switch SG1/4 (Sensor ON/OFF) is used for selecting the sensor fibre.

The light captured by the sensor fibre is amplified and compared either to an automatic or a manual reference level. Once the reference level has been exceeded, a light signal is generated and the signal relay (Light) is activated for about 0.5 second. In a trip situation, the central unit REA 101 or the REA 105 unit itself provides information about the tripping, and the signal relay is locked in the active state. If no tripping occurs, the relay resets.

The SG1/3 switch (Automatic light ref. level ON/OFF) is used for selecting the automatic or manual reference level. The unit itself forms the automatic reference level according to the present backlight intensity measured by the sensor fibre. The potentiometer "Light Ref. Level Adj." on the front panel is used for setting the manual reference level.

The sensor fibre is monitored by sending a test pulse through the fibre. Unless the test pulse is received at regular time intervals at the other end of the loop, the sensor fault LED "Fault" and the IRF indicator LED "IRF" are activated.

Condition monitoring of the sensor fibre can be deactivated with the switch SG1/8 (Sensor supervision deactivation ON/OFF), in which case a radial, i.e. a terminating, fibre can be used.

When the switch SG1/5 (Light to port IN1 ON/OFF) is in the OFF position, no light signal is transmitted to the REA 101 unit located in the direction of the port IN1, and the REA 105 extension unit alone carries out tripping if the REA 101 unit delivers an overcurrent signal at the same time.

When the switch SG1/5 is in the ON position, the light signal is transmitted to the central unit REA 101. Both the REA 105 and the REA 101 unit trip if the overcurrent signal is active.

Delayed tripping by REA 101 is explained in section "Circuit-breaker failure protection".

The REA 105 unit does not send a light signal to the port IN2.

4.2. Trip output

The trip output contains two high-speed, galvanically isolated IGBT semi-conductor outputs (HSO1 and HSO2). These outputs can be used in DC and AC circuits. The control signal of the outputs is activated if the unit detects light and the central unit REA 101 delivers an overcurrent signal, provided the operating voltage fault signal is inactive.

Once the central unit REA 101 performs tripping, all the REA 105 extension units connected to it trip as well. When the REA 105 trips, the outputs remain in the active state.

The outputs are reset by pressing the Reset push-button or via the RESET input of the central unit.

4.3. Operation of IN1 and OUT1 ports

The ports IN1 and OUT1 are connected in parallel. The connection cable from the central unit REA 101 is connected to the port IN1 and the connection cable to the next extension unit departs from the port OUT1. A maximum of five extension units, one after the other, can be linked to one port of the central unit.

The terminator of the last extension unit has to be connected using the switch SG1/1: Terminator 1 ON/OFF. This allows the REA 101 unit to monitor the condition of the connection cable.

Should the terminator be unconnected, the fault indicating LED "Port A/B Fault" of the central unit REA 101 and the IRF indicator LED "IRF" are activated, and the IRF relay resets. The REA 105 extension unit gets the operating voltage over the port IN1.

4.4. Operation of port IN2

Port IN2 is used when the ports of two REA 101 units are to be connected together, for instance, for the transfer of overcurrent signals. (See sections "Functions of LEDs and switches" and "Application examples" of the REA 101 Operator's manual 1MRS 751003-MUM.

In this case, the ports must be terminated, that is, the terminators for both ports IN1 and IN2 have to be connected (switches SG1/1-2).

The port is galvanically isolated from the rest of the device, because otherwise possible potential differences between the central units might cause problems.

4.5. Circuit-breaker failure protection

The circuit-breaker failure protection is implemented by delaying the light signal that is transmitted to the bus via the IN1 port.

The switch SG1/6 (Delayed light to port IN1 ON/OFF) is used to activate the circuit-breaker failure protection.

When the circuit-breaker failure protection is in use, the switch SG1/5 (Light to port IN1 ON/OFF) has to be in the OFF position.

The desired delay time, 100 ms or 150 ms, is selected with the switch SG1/7 (Delay ON = 150 ms, OFF = 100 ms). Once the REA 105 unit trips, the delay time starts running. If the overcurrent signal is active when the delay time runs out, the REA 105 extension unit transfers a light signal to the port IN1 and delayed tripping will be carried out by the REA 101 unit.

Should the overcurrent signal disappear during the time delay, no light signal will be transmitted by the REA 105 unit, and no delayed tripping will be performed by the REA 101 relay.

4.6. Self-supervision unit (IRF)

In addition to that mentioned above, the self-supervision unit monitors the operating voltages of the device. If a fault is detected in the operating voltages, the self-supervision unit prevents the device from operating. When the LED indicator "IRF" of the REA 105 unit is lit, the LED "Port A/B Fault" of the REA 101 relay starts flashing, the LED indicator "IRF" is activated and the IRF relay resets.

4.7. Front panel

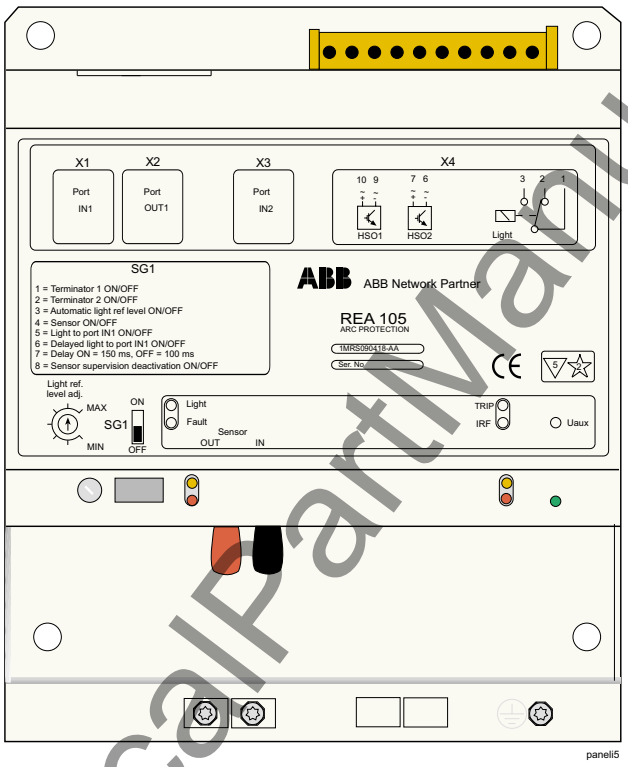

Fig. 4.7.-1 Front panel

4.8. Functions of LEDs and switches

LEDs activated:

U_{aux}	Power supply is connected
Light	The sensor fibre has detected light
TRIP	The unit has tripped
IRF	The self-supervision system has detected a fault (The fault LED *Port A/B Fault* of the REA 101 relay is flashing, the IRF indicator is lit, and the IRF relay has reset)
Fault + IRF	Sensor fibre broken (The sensor fibre may still detect light between the sensor input and the breakage) Transmitter/transceiver is defective

Light Ref. Level Adj.:

Potentiometer for manual backlight compensation:

- potentiometer in use, if switch SG1/3 in OFF position.
- potentiometer not in use, if switch SG1/3 in ON position.

Switchgroup SG1:

1. Switch 1 (Terminator IN1 ON/OFF)
   Switch in ON position: Terminator IN1 connected
2. Switch 2 (Terminator IN2 ON/OFF)
   Switch in ON position: Terminator IN2 connected
3. Switch 3 (Automatic light ref. level ON/OFF)
   Switch in ON position: Automatic backlight compensation selected (Potentiometer Light Ref. Level Adj. not in use)

   Switch in OFF position: Manual backlight compensation selected (Potentiometer Light Ref. Level Adj. in use)
4. Switch 4 (Sensor ON/OFF)
   Switch in ON position: The sensor fibre is used for arc detection
5. Switch 5 (Light to port IN1 ON/OFF)
   Switch in ON position: A light signal detected by the REA 105 is transmitted to the REA 101 unit linked to the port IN1. (When the REA 101 unit trips, the REA 105 extension units connected to it trip as well.)

   Switch in OFF position: No light signal is transmitted to the port IN1.
6. Switch 6 (Delayed light to port IN1 ON/OFF)
   Switch in ON position: Circuit-breaker failure protection in use.
   The selected time delay (SG1/7) is started by the tripping of the REA 105 unit. If the overcurrent signal is still active when the time delay elapses, the REA 105 unit transmits a light signal to the higher-level REA 101 unit linked to the port IN1.

   Switch in OFF position: No delayed light signal is transmitted to the port IN1.
7. Switch 7 (Delay ON = 150 ms, OFF = 100 ms)
   This switch is only used together with the circuit-breaker failure protection (SG1/6 in ON position)

   Switch in ON position: Delay = 150 ms

   Switch in OFF position: Delay = 100 ms
8. Switch 8 (Sensor supervision deactivation ON/OFF)
   Switch in ON position: Sensor fibre loop condition monitoring not in use, i.e. a radial fibre may be used

   Switch in OFF position: Sensor fibre loop condition monitoring in use.

5. Connections

Connection ports:

X1	Port IN1
X2	Port OUT1
X3	Port IN2

Connector X4:

1	Light common	Signal relay of sensor
2	Light /NC	Signal relay of sensor
3	Light /NO	Signal relay of sensor
4	Not in use	
5	Not in use	
6	HSO2 -(~)	Heavy-duty high-speed semi-conductor output 2
7	HSO2 +(~)	Heavy-duty high-speed semi-conductor output 2
8	Not in use	
9	HSO1 -(~)	Heavy-duty high-speed semi-conductor output 1
10	HSO1 +(~)	Heavy-duty high-speed semi-conductor output 1

Sensor fibre connectors:

Sensor	OUT
Sensor	IN

6. Commissioning

6.1. Instructions for commissioning:

The following procedure should be followed when the unit is commissioned:

All switch settings have to be made before the auxiliary voltage of the unit is connected.

1 Switchgroup SG1:

Default setting: SG1= 0000000

Set the switches as required by the application. See sections "Function of LEDs and switches" in this manual and "Application examples" of the REA 101 Operator's manual 1MRS 751003-MUM.

2 Terminator:

Check that the terminator of the last extension unit of each extension unit chain is connected, i.e. switch SG1/1 is in position ON. In some applications the switch SG1/2 is set in position ON, too.

3 Potentiometer Light Ref. Level Adj:

Default setting: middle position.
If the SG1/3 switch is set for automatic backlight compensation, the setting of the potentiometer does not have to be changed.

6.2. Testing of arc protection system level

1. Check the current measurement function of each REA 101 relay by measuring the primary or secondary circuit.

   When the current limit is exceeded, the "I> Start" LED of the concerned relay is lit.

2. Turn the "Trip Condition" key switch into position *Light* to check that overcurrent data is transmitted through the entire system arrangement, as required by the application.
3. Check that the LED "I>Start" of the concerned REA 101 units is lit.
4. Finally, turn the "Trip Condition" key switch into position *I> & Light*.
5. Check each REA 101 relay included in the application in the same way.

6.3. Light reference setting

1. Set the lighting level as close to normal work conditions as possible.
2. Turn the "Light Ref. Level Adj." potentiometer until the "Light" LED is lit or goes out.
3. Turn the potentiometer one scale mark interval to the right.
4. Should the "Light" LED remain dark, even though the potentiometer is in the Min. position, the potentiometer can either be left in this position or turned one scale mark interval to the right, depending on the sensitivity level desired.
5. Turn the key switch "Trip Condition" of one REA 101 relay into position *Light*.
6. Expose one sensor fibre at a time to light, for example using a flash, and check that the right circuit breakers operate.
7. When all of the sensor fibres have been tested, set the Trip Condition key switch/key switches as required by the application.

The Trip Condition key switch must always be in an extreme position.

7. Dimensions and fixing

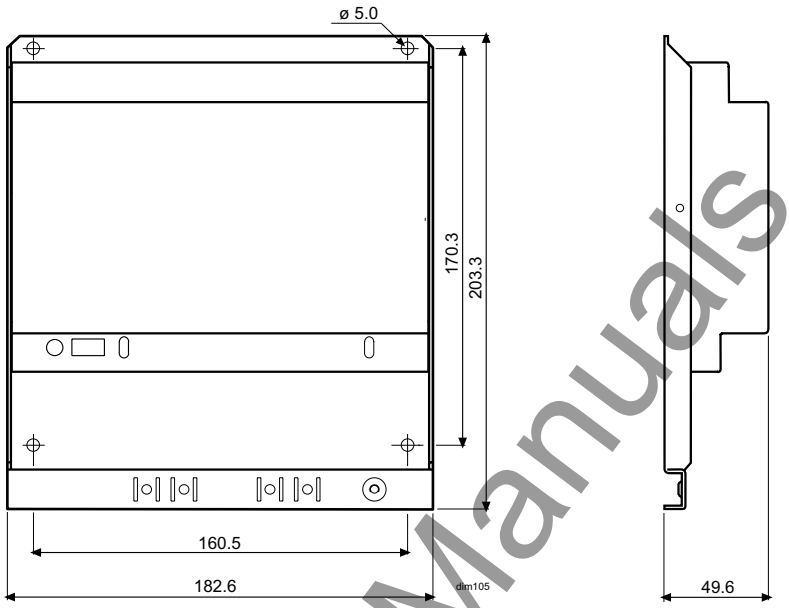

Fig. 7.-1 Dimensions

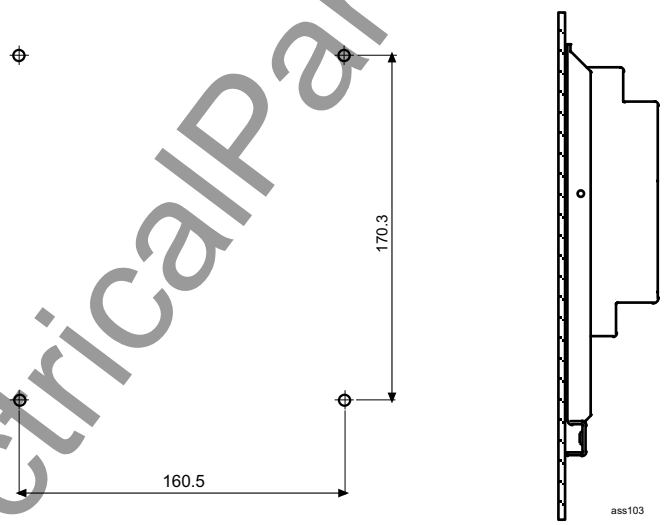

Fig. 7.-2 Fixing methods

The fixing method recommended:

Method 1: M4 threaded hole, fixing with M4 machine screw.

Method 2: ϕ 4.2 mm hole, fixing with M4 machine screw and a nut.

8. Technical data

Signal contacts (Light)	
Maximum system voltage	250 V dc/ac
Continuous carry	5 A
Make and carry for 0.5 s	10 A
Make and carry for 3 s	8 A
Breaking capacity for dc, when the control circuit time constant L/R <40 ms, at 48/110/220 V dc	1 A/0.25 A/0.15 A
Outputs	
Trip contacts HSO1 and HSO2:	
Maximum system voltage	250 V dc/ac
Continuous carry	1.0 A
Make and carry for 0.5 s	30 A
Make and carry for 3 s	15 A
Breaking capacity for dc, when the control circuit time constant L/R <40 ms, at 48/110/220 V dc	5 A/3 A/1 A
Power consumption (operating voltage over the port of REA 101)	
Under quiescent conditions/maximum Note: Maximum of 5 extension units can be linked to one port of REA 101	~2.7 W/~3.7 W
Sensor fibre	
Maximum length without splices or with one splice	60 m
Maximum length with two splices	50 m
Maximum length with three splices	40 m
Service temperature range	-35...+80°C
Minimum permissible bending radius	50 mm
Connection cable	
Maximum length	40 m
Total operate time	
HSO1 and HSO2	≤2.5 ms
Environmental tests	
Specified service temperature range	-10...+55°C
Transport and storage temperature range	-40...+70°C
Dry heat test	Acc. to IEC 60068-2-2
Dry cold test	Acc. to IEC 60068-2-1
Damp heat test cyclic	Acc. to IEC 60068-2-30 r.h. >95%, t = 20...55°C
Storage temperature test	Acc. to IEC 60068-2-48
Standard tests	
Insulation tests	
Dielectric test IEC 60255-5 Test voltage	2 kV, 50 Hz, 1 min
Impulse voltage test IEC 60255-5 Test voltage	5kV, unipolar impulses, waveform 1.2/50 µs, source energy 0.5 J
Insulation resistance measurements IEC 60255-5	>100 MW, 500 Vdc
Mechanical tests	
Vibration tests (sinusoidal)	IEC 60255-21-1, class 1
Shock and bump test	IEC 60255-21-2, class 1

Seismic test	IEC 60255-21-3, class 2
Electromagnetic compatibility tests	
The EMC immunity test level fulfills the requirements listed below	
1 MHz burst disturbance test, class III, IEC 255-22-1	common mode
	differential mode
Electrostatic discharge test, class III IEC 61000-4-2 and 60255-22-2	contact discharge
	air discharge
Radio frequency interference test	conducted, common mode IEC 61000-4-6
	radiated, amplitude modulated IEC 61000-4-3
Fast transient disturbance test	IEC60255-22-4 and IEC 61000-4-4
Surge immunity test IEC 61000-4-5:	
- trip outputs	common mode
	differential mode
- signal output contacts	common mode
	differential mode
Electromagnetic emission tests EN 55011 and EN 50081-2	radiated RF emission
Enclosure	
Degree of protection, IEC 60529	IP 20
Weight	~1.1 kg
CE approval	
Complies with the EMC directive 89/336/EEC and the LV directive 73/23/EEC.	

9. Order information

Order numbers

Arc protection relay REA 101 U_n = 110…240 V ac U_n = 110…220 V dc	1MRS 090416-AAA *)
Arc protection relay REA 101 U_n = 24…60 V dc	1MRS 090416-CAA *)
Arc protection relay REA 101 with optolink connectors for glass fibre U_n = 110…240 V ac U_n = 110…220 V dc	1MRS 090416-AAAG *)
Arc protection relay REA 101 with optolink connectors for glass fibre U_n = 24…60 V dc	1MRS 090416-CAAG *)
Rear plate protective cover	1MRS 060196
Mounting kit for semi-flush mounting	1MRS 050254
Mounting kit for surface mounting	1MRS 050240
Mounting kit for connecting cases together	1MRS 050241
Mounting kit for 19" rack	1MRS 050258
Extension unit REA 103	1MRS 090417-AA
Extension unit REA 105	1MRS 090418-AA
Extension unit REA 107	REA 107-AA

*) Includes mounting kit 1MRS 050209 for flush mounting

Pre-manufactured fibre sensors

Length	Order number
5 m ±3%	1MRS 120512.005
10 m ±3%	1MRS 120512.010
15 m ±3%	1MRS 120512.015
20 m ±3%	1MRS 120512.020
25 m ±3%	1MRS 120512.025
30 m ±3%	1MRS 120512.030
40 m ±3%	1MRS 120512.040
50 m ±3%	1MRS 120512.050
60 m ±3%	1MRS 120512.060

Accessories for manufacturing fibre sensors

Sensor fibre 100 m	1MSC 380018.100
Sensor fibre 300 m	1MSC 380018.300
Sensor fibre 500 m	1MSC 380018.500
ST connector	SYJ-ZBC 1A1
ST splice adapter	SYJ-ZBC 1A2
ST fibre termination kit	1MSC 990016

Pre-manufactured lens sensors for REA 107

1,5 m ±3%	1MRS 120534-1.5
3 m ±3%	1MRS 120534-3.0
5 m ±3%	1MRS 120534-5.0
7 m ±3%	1MRS 120534-7.0
10 m ±3%	1MRS 120534-10
15 m ±3%	1MRS 120534-15
20 m ±3%	1MRS 120534-20
25 m ±3%	1MRS 120534-25
30 m ±3%	1MRS 120534-30

Pre-manufactured lens sensors for REA 101, REA 103 and REA 105

2 m ±3%	1MRS 120536-2
3 m ±3%	1MRS 120536-3
5 m ±3%	1MRS 120536-5
10 m ±3%	1MRS 120536-10

Spare parts for lens sensors

Light collecting lens	1MRS060743

Cables for connecting REA 101 to an extension unit or extension units to each another

1 m ±3%	1MRS 120511.001
3 m ±3%	1MRS 120511.003
5 m ±3%	1MRS 120511.005
10 m ±3%	1MRS 120511.010
15 m ±3%	1MRS 120511.015
20 m ±3%	1MRS 120511.020
30 m ±3%	1MRS 120511.030
40 m ±3%	1MRS 120511.040

Plastic fibre optolink for signal transfer between central units

1 m ±3%	SPA-ZF AA 1
2 m ±3%	SPA-ZF AA 2
3 m ±3%	SPA-ZF AA 3
5 m ±3%	SPA-ZF AA 5
10 m ±3%	SPA-ZF AA 10
20 m ±3%	SPA-ZF AA 20
30 m ±3%	SPA-ZF AA 30
40 m ±3%	1MRS 120517

Glass fibre optolink for signal transfer between central units

50 m ±3%	SPA-ZF1MM50
60 m ±3%	SPA-ZF1MM60
70 m ±3%	SPA-ZF1MM70
80 m ±3%	SPA-ZF1MM80
90 m ±3%	SPA-ZF1MM90
100 m ±3% *)	SPA-ZF1MM100

*) Note! Lengths over 100 m on request, max. length 2000 m.

10. References

REA10_ Technical Overview Brochure	1MRS 750929-MBG
REA101 Operator's Manual	1MRS 751003-MUM
REA103 Operator's Manual	1MRS 751004-MUM
REA107 Operator's Manual	1MRS 752135-MUM

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