esense

esense troubleshoot guide

E1409-9000 series

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2.1 Introduction

This guide helps in fault analysis of esense 9000 systems with esense Main firmware version 1.00.05 and esense Up firmware version 1.00.04 and later. For effective troubleshooting on systems with older firmware, first use PowerTalk to update to the latest firmware.

For general instructions on use of the system refer to the esense User manual. For general instructions on installation and maintenance, including more detailed instructions for (re)placement of components refer to the esense Installation and service manual.
A detailed overview with article numbers and names of all system components and pre-defined system configurations and any available alternative, accessory and spare parts can be found in the esense Article overview.

Component descriptions in this document generally refer to components in the pre-defined configurations E1409-9010 to 9090. In case components in these configurations are replaced by alternative components (sensor or disconnectable charger and connector) the description is applicable for these alternative components.

2.2 First things first

In case a service call is received it is most important to make sure the user can continue use of a trolley, either with or without esense drive functionality.

First check if the user can easily solve the problem, when it for instance concerns:
- Emergency switch unintendedly pressed
- Immobilizer unintendedly activated
- Key lock unintendedly activated.

See section 3.1, table 1 to recognize these situations.

In case solving the issue is not possible remotely make sure the trolley can be used without electric power assistance until repair is made. Notice the user that:
- The Drivewheel of Driveunit 360 can be turned in forwards/ backwards direction by hand in case the system failed when the wheel was turned sideways.
- In the Drivewheel of Driveunit Up is in lowered position it can be moved up by pressing the Right/ Raise switch.
- The Drivewheel is in freewheel mode when the system is switched off. Therefore the trolley can still be safely moved around.
- The Drivewheel may (optionally) be provided with a mechanical emergency wheel lift (E1106-8000).

2.3 Interface elements

In most cases the first step in fault analysis of esense systems is to understand the indications on the User Interface. The troubleshoot tables in the next chapter refer to indication and switch names as listed in below overview.

The availability of indications depends on the system configuration. For instance on systems without esense Batterypack battery indications can not be showed and indications for Key lock and Immobilizer can only be showed when this functionality is activated during installation.
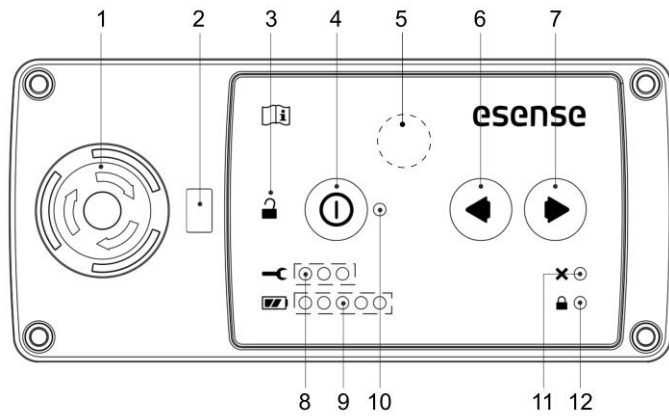
1. Emergency switch	Active on all versions.
2. USB connector	Active on all versions.
3. Magnet key lock	Optional functionality, to be activated by the trolley supplier.
4. On/ off switch	Active on all versions.
5. Hidden key lock switch	Optional functionality, to be activated by the trolley supplier.
6. Left/ Lower switch	Drive left for 360 versions, lower wheel for Up versions.
7. Right/ Raise switch	Drive right for 360 versions, raise wheel for Up versions.
8. Service indication	Active on all versions, but only lit in case of service errors.
9. Battery indication	Active on Power and Box systems.
10. System status indication	Active on all versions.
11. Immobilizer indication	Optional functionality, to be activated by the trolley supplier.
12. Key lock indication	Optional functionality, to be activated by the trolley supplier.

More information on changing system configurations and options can be found in the Installation and service manual.

2.4 Service indications

The service indication consists of three different LEDs. These LEDs communicate codes indicating specific groups of system faults.

Service indication	Number	Description
	1	System error
	2	Pushbar error
	3	Interface error
	4	Drive error
	5	Steer or Lift error

More specific information on the issue is showed in the battery indication when the left or right docking switch (6 or 7) is pushed. The combination of both codes is used in the tables in chapter 3.

2.5 PowerTalk Log file

A next powerful source for fault analysis is the esense Log file. This Log file can be viewed using PowerTalk. With PowerTalk, the user may also send a system report for remote analysis. For more information on the use of PowerTalk see the Installation and service manual.

> **Notice!**
> The Log file can be found under the tab 'Log' in PowerTalk for users with license level L2 and L3. PowerTalk users with license level L1 can view the Log file by using the 'Save report' function. The report can next be opened with an internet browser. The Log forms the last part of the report.

The entries may be system faults, but can also be perfectly harmless. Log entries that may be ignored during troubleshooting are listed below.

Log entry	Meaning
System started	System switched on.
System stopped	System switched off.
Charger detected	System has been connected to a charger.
EMO pressed	The emergency stop is pressed.
Drive unit has recalibrated	The Driveunit 360 has automatically corrected its center position.

All Log entries indicating system faults are listed in the troubleshoot tables in chapter 3. System faults are logged at the same time as service indications are showed on the User Interface.

2.6 Use of the troubleshoot tables

This guide provides tables that give direction in effective troubleshooting. The first column of each table lists the indication that is showed when the system is in service mode. The next column shows the Log entry concerning the same fault.

The next five columns show steps to solve the issue, in order of relevance. In most cases step 1 will be sufficient.

The tables use several symbols, as listed below.

Symbol	Meaning
☒	Component failure suspected.
⚪	Indication off.
🌓	Indication blinking.
🟠	Indication constantly lit.

The first table (3.1) is a general table, listing general interface indications and system behavior. This table refers to the other tables for more detail.

2.7 General guidelines

- Make sure to have relevant spare parts at hand. Standard sets are available. Contact your esense supplier for details.
- When a component is listed with the ☒ symbol it is expected to be the reason for system failure. First replace the listed component with a spare version. If this fixes the problem, replace the component with the spare version. If it does not solve the problem return the original part and continue with the next step.
- Always first try to reconnect the connectors of the cable before full replacement of the cable.
- If the steps in the tables did not solve the issue, as a last step try to replace the esense Controller box.

2.8   Log entry reference table

The troubleshoot tables in the next chapter are ordered by service indication on the esense User Interface. Use the reference table, with Log entries on alphabetical order, when troubleshooting is done on log entry only.

Log entry	Troubleshoot table
BLDC controller fault	Table 5
BLDC undervoltage	Table 5
Charger detected	Paragraph 2.5
Driveunit could not find center position	Table 6
Driveunit DC motor fault	Table 6
Driveunit has recalibrated	Paragraph 2.5
EMO pressed	Paragraph 2.5
File system read/ write error	Table 2
Modbus offline	Table 5
Pushbar cable break detected	Table 3
Pushbar calibration fault	Table 3
Pushbar offset fault	Table 3
Pushbar out of range	Table 3
Sticky button detected	Table 4
System safe mode	Table 2
System started	Paragraph 2.5
System stopped	Paragraph 2.5
UI CAN offline	Table 4
UI unexpectedly restarted	Table 4

3 Troubleshoot tables

3.1 Table 1: Primary indication overview

Indication	Description	Step 1	Step 2	Step 3	Step 4	Step 5
(power button, grey LED)	System does not start at all.	Charge the Batterypack and check Voltage and Capacity with PowerTalk.*	☒ Batterypack → ☒ Charger	☒ esense Membrane Foil (On/ off button)	☒ CAB100 UI 2 – Box.	☒ esense UI 2 → ☒ esense Controller Box.
(power button, grey LED)	System does not start for some time (up to a few hours).	☒ Batterypack ☒ Charger See remark **				
(power button, grey LED)	System switches off after a few seconds or when first pushing the Sensor handles.	Charge the Batterypack and check Voltage and Capacity with PowerTalk.*	☒ Batterypack → ☒ Charger			
(wrench, orange LEDs)	One or more service LEDs are lit.	See table 2-6.				
(power button, green LED)	'System ready' indication is lit, but trolley performance is not correct.	See table 7.				
(power button, green LED)	System performance is correct now, but customer reports previous service indications.	Read the system Log file with PowerTalk.	See table 2-6.			
(cross, yellow LED)	Immobilizer LED is lit.	Check cables and switches connected to input C4 on CAB111 Main IO v3.	Toggle the immobilizer polarity with PowerTalk.	☒ CAB111 Main IO v3.		
(lock, yellow LED)	Key lock LED is lit.	Unlock the Key lock. (Magnet or 4x Hidden key lock switch).	Change the Key lock activation with PowerTalk.			

All LEDs on the interface are blinking.	Unlock emergency switch and reactivate system.	☒ EMO Switch.	☒ CAB100 UI 2 – Box.	
One or more battery level indication LEDs are blinking.	See table 8.			

* The Voltage and Remaining capacity of the esense Batterypack can be checked in PowerTalk under tab Values; Battery/ Battery voltage and Battery/ Battery current. For esense Batterypacks the Relative remaining capacity must always be above 10%, in combination with a Voltage between roughly 24 and 27 V. If the Voltage is lower, the Battery may not have been charged for a long time or the Batterypack may be broken and is not able to hold capacity long anymore.

** If a system is not able to start up for some time (up to a few hours), this may be caused by a safety procedure in the esense Batterypack.

> **Notice!**
> Below instruction is applicable only for systems including the esense Batterypack.
> Esense Basic systems (E1409-9010 and 9040) are powered by alternative power sources. Refer to the service instructions of these power sources for troubleshooting information.

It's advised to try a restart after a few hours or, if that was not successful, after connection or disconnection of the charger to the mains. Next, the cause may be found with PowerTalk under tab Values; Battery/ Info/ Last 10 cutoff reasons. The displayed value is a log for cut-off of the battery. In these situations, power from the battery is temporarily switched off by the battery electronics, because an unusual and potentially harmful event happened. The log fills from right to left; so the most **right** number is the latest event.

#	Meaning	Cause/ action
1	Battery voltage too low	The Batterypack was not charged for a long period or the Battery is broken. • Check with the user if the product was not charged for a long time (months), for instance due to storage. • Check if charging is still working. See remark ** below table 8. Replace the **Batterypack** or **Charger** if necessary.
2	Discharge current too high	The current required by the Drivewheel is higher than the Batterypack is able to deliver. This fault expectedly does not occur in normal use scenario's. Please contact a product specialist at Indes in case this fault is logged frequently.
3	Battery temperature too high	The batterypack has been too warm. This may be caused by an external or internal heating of the cells during charging. • Thoroughly check if the batterypack is used in warm (45 °C+) environments or if the batterypack is installed close to any heatsources. • Replace the **Batterypack** if both external sources can be excluded and the issue is logged frequently.
4	Charge voltage too high	The supply voltage of the charger is incorrect. Make sure the original esense charger is used. Replace the charger in case the fault is logged frequently.
5	Charge current too high	The supply current of the charger is incorrect. Make sure the original esense charger is used. Replace the charger in case the fault I logged frequently.

3.2 Table 2: System service indications

Indication	Log entry	Step 1	Step 2	Step 3	Step 4	Step 5
⊸ ● ○ ○ ▱ ○ ○ ● ○ ○	File system read/ write error. *	Check frequency of the fault in the Log file with PowerTalk.	If the fault was an isolated incident (only a few in past months) no further action is needed.	☒ esense Controller Box.		
All LEDs on the interface are on.	System safe mode. **	Check frequency of the fault in the Log file with PowerTalk.	If the fault was an isolated incident (only a few in past months) no further action is needed.	Use PowerTalk to set the right dipswitch for your system configuration.	☒ esense Controller Box.	

* In most cases this error does not lead to the system switching to service mode. Therefore, the user may not notice anything. Incidental occurrence is no reason for replacement of the esense Controller Box.

** The esense Controller Box switches to system safe mode when an error occurs that is potentially harmful for the controller. Incidental occurrence is no reason for replacement of the esense Controller box.
The system also switches to safe mode when the system configuration does not match with the software version on the esense Controller Box. This can be corrected by setting the correct system type with PowerTalk (User Level 3 only).

3.3 Table 3: Pushbar service indications

Indication	Log entry	Step 1	Step 2	Step 3	Step 4	Step 5
	Pushbar out of range. *	Check sensor signals with PowerTalk.	Loosen and reassemble the failing Sensor handle.***	Use a plastic hammer to shift the sensor signal back in range.****	☒ Sensor Handle.	☒ esense UI 2.
	Pushbar cable break detected. *	Check sensor signals with PowerTalk.	☒ Check ground connection of Sensor Handles.**	☒ Sensor Handle.	☒ esense UI 2.	
	Pushbar offset fault. *****	Check if objects near the Sensor Handles risk to push or clamp on the sensor.	Check if Sensor Handles are used correctly. Both hands must be placed fully on the handles during use.	Try to reproduce the fault. Loosen and reassemble the failing Sensor handle.***	Contact Indes to discuss options to modify Pushbar offset fault settings.	
	Pushbar calibration fault	Inform end user on calibration step. ******				

* Sensor signals can be checked on the overview and values screens of Powertalk. A sensor signal should be between 400 and 550 when in rest (not pushed). In case the sensor is outside of this range at start-up of the system, calibration will fail.

In case a sensor signal exceeds the range of 130 – 870 a cable break is detected.

Check which sensor (S1 or S2) causes the failure and locate this sensor by following the cable leading from esense UI 2.

> **Notice!**
> Sometimes the Log file shows a (double) cable break directly after the system was stopped. This notification is caused by a timing issue; during switch off of the system the voltage of the sensors drops, causing extreme sensor values. In some cases the Main controller is still able to detect and log this.
>
> | 920 | 2018-09-17 06:25:19 | 1943 24020000 | 080 Pushbar cable break detected |
> | 919 | 2018-09-17 06:25:19 | 1943 04020000 | 080 Pushbar cable break detected |
> | 918 | 2018-09-17 06:25:18 | 295 00000000 | 064 System stopped |
>
> **These notifications, after 'System stopped' may be ignored!**

** In case the LOG file show multiple 'Pushbar cable break detected' faults at apparently random moments that cannot be reproduced during evaluation, this may be caused by insufficient grounding of the Sensor Handles. As described in the installation instructions, the Sensor Handles must be mounted to a tube that is electrically connected to the larger metal frame of the trolley. Please check if this is properly done.

*** Please refer to the Installation and maintenance manual for instructions on installation of Sensors and Sensor handles. To operate correctly the handle parts of Sensor Handles shall be mounted with a free space of 1 mm around the surface of the tube they are mounted on. The tube shall have a diameter of 25 mm ± 0.1.

**** Hard shocks on a sensor handle may shift the sensor signal at rest. When a signal is not too far outside the 400 – 550 range, between 300 and 650, the sensor can often be repaired. Use a plastic hammer and hit the sensor handle in forwards or backwards drive direction. Hit in the area where the handle is most wide, next to the clamp part. Do not hit too hard, but shift the signal in a few repeated hits. Stop when the signal stabilizes between 450 – 500.

***** Offset faults are generally caused by objects pushing or clamping on the sensor or by deviating (mis)use. Check with the end users if this is the case and make sure the Sensor Handles are pushed in the same way as described in the user manual. In case of frequent occurrence during normal use in some situations system settings may be changed to limit the chance on offset faults. Please contact Indes for this.

****** During calibration, at start-up of the system, the sensors need to be untouched. An alarm sounds after 10 seconds if a user already starts pushing during calibration. After 20 seconds the system switches to service mode and a Pushbar Calibration Fault is logged. This fault is not caused by component failure but by human error. Please notifiy the end user to be more patient during calibration.

3.4 Table 4: User Interface service indications ⌐C 🟠🟠⚪

Indication	Log entry	Step 1	Step 2	Step 3	Step 4	Step 5
⌐C 🟠🟠⚪ 🔋 ⚪🟡⚪⚪⚪	UI CAN offline.	Reconnect CAB100 UI 2 – Box. Specifically connector C3.	☒ CAB100 UI 2 – Box.	☒ esense UI 2.		
⌐C 🟠🟠⚪ 🔋 🟠🟡⚪⚪⚪	Sticky button detected. *	Check frequency of the fault in the Log file with PowerTalk.	If the fault was an isolated incident (only a few in past months) no further action is needed.	☒ esense Membrane Foil.	☒ esense UI 2.	
⌐C 🟠🟠⚪ 🔋 ⚪⚪🟢⚪⚪	UI unexpectedly restarted.	Check frequency of the fault in the Log file with PowerTalk.	If the fault was an isolated incident (only a few in past months) no further action is needed.	☒ esense UI 2.	☒ esense Membrane Foil.	☒ CAB100 UI 2 – Box.

* Sticky button detection checks if any switches on the esense Membrane Foil are continuously activated (pushed). If a button is pushed at start-up of the system calibration is postponed. If the button remains activated for 20 seconds, the system switches to service mode and the error is logged. This may occasionally happen during normal use, but repeated occurrence indicates a system fault.

3.5 Table 5: Drive service indications

Indication	Log entry	Step 1	Step 2	Step 3	Step 4	Step 5
	Modbus offline.	Reconnect the connectors in C7 and C12 of the esense Controller box.	☒ Fuse 58V/ 20A on esense Controller Box.	☒ esense Controller Box.		
	BLDC undervoltage. *	Check frequency of the fault in the Log file with PowerTalk.	If the fault was an isolated incident (only a few in past months) no further action is needed.	☒ Batterypack.	☒ E1106-0666 Drivewheel.	
	BLDC controller fault.	Reconnect CAB029 360 Wheel – Box *or* CAB040 Fixed Wheel – Box.	☒ CAB029 360 Wheel – Box *or* ☒ CAB040 Fixed Wheel – Box.	☒ E1106-0666 Drivewheel.	☒ E1106-1000 Driveunit 360.	

* BLDC undervoltage indicates that the voltage for the Drivewheel has been too low. This typically happens when the Drivewheel needs a sudden high current; for instance, when passing thresholds or slopes or with sudden change in drive direction. During these peak currents the voltage of the Batterypack drops. Due to aging effects of the Batterypack the voltage drop may get too high.

3.6 Table 6: Steer and Lift service indications 🔧 🟠 ⚪ 🟠

Active on E1409-9040/ 9050 and 9060 only.

Indication	Log entry	Step 1	Step 2	Step 3	Step 4	Step 5
🔧 🟠⚪🟠 🔋 ⚪🟡⚪⚪⚪	Driveunit could not find center position.	Reconnect CAB033 Position – Main IO.	☒ CAB033 Position – Main IO.	☒ CAB111 Main IO v3.	☒ E1106-1000 Driveunit 360.	
🔧 🟠⚪🟠 🔋 🟠🟡⚪⚪⚪	Driveunit DC motor fault.	Reconnect CAB032 Steering – Box.	☒ CAB032 Steering – Box.	☒ CAB111 Main IO v3.	☒ E1106-1000 Driveunit 360.	
🔧 🟠⚪🟠 🔋 ⚪⚪🟢⚪⚪	Driveunit Lift motor fault.	Reconnect CAB123 Lift – Box.	☒ E1909-0110 Up lift motor cable	☒ E1909-0100 Up lift motor	☒ CAB123 Lift - Box	

3.7 Table 7: Unexpected trolley performance

Indication	Description	Step 1	Step 2	Step 3	Step 4	Step 5
⏻ 🟢	Drive functionality remains inactive.	Reconnect CAB029 360 Wheel – Box *or* CAB040 Fixed Wheel – Box.	☒ CAB029 360 Wheel – Box *or* ☒ CAB040 Fixed Wheel – Box	☒ E1106-0666 Drivewheel.	☒ E1106-1000 Driveunit 360.	
⏻ 🟢	The trolley does not brake automatically when the Sensor Handles are released.	Loosen and reassemble the Sensor Handles. *	☒ Sensor Handle.			
⏻ 🟢	The trolley automatically brakes unexpectedly	Check and correct the ground connection of the esense Controller box.***				
⏻ 🟢	Users report mild static discharge shocks during use of the Sensor handles.	Use anti-static castors or an anti-static strip on the trolley.****				
⏻ 🟢	The trolley drives short distances by itself.	Evaluate the facility floor on unevenness. **	Check if objects near the Sensor Handles risks to push or clamp on the sensor.	Loosen and reassemble the Sensor Handles. *	☒ Sensor Handle.	
⏻ 🟢	The trolley cannot be moved at all.	Check if the Drivewheel is blocked from the outside. Remove any obstacles.	☒ E1106-0666 Drivewheel.			
⏻ 🟢	The trolley cannot easily be moved in a straight line.	Check if any trolley wheels are blocked from the outside.	Remove any obstacles from the wheels and make sure the wheels can spin freely.			
⏻ 🟢	The Driveunit 360 does not rotate sideways when a sideways switch is pushed.	☒ esense Membrane Foil.				

* Please refer to the Installation and maintenance manual for instructions on installation of Sensors and Sensor handles. To operate correctly the handle parts of Sensor Handles shall be mounted with a free space of 1 mm around the surface of the tube they are mounted on. The tube shall have a diameter of 25 mm ± 0.1.

** The electric brake of the esense system is switched off when the trolley is standing still. In case the trolley is standing on an uneven or slightly sloping floor the trolley may start moving due to gravitational force. To secure a full standstill of the trolley the parking brakes of the trolley shall be used.

*** As described in the installation instructions, the esense Controller box or Enclosure must have a ground connection to the larger metal frame of the trolley. If this connection is not properly made, this may lead to EMC/ ESD issues that result in unexpected braking behavior during driving. Please check if the Controller box or the ground connection of the Enclosure is properly connected to an uncoated part of the steel construction. An optional ground wire is available to create a proper connection.

**** In some occasions, for specific products, electric discharge shocks have been reported. Although the exact cause of this phenomena has not been found (yet), use of anti-static castors or anti-static strips has proven to be a suitable solution.

3.8 Table 8: Battery level indications ▱ ◓ 🟡 🟢 🟢 🟢

Active on E1409-9020/ 9030/ 9050/ 9060 and E1909-9080 / 9090 only.

Indication	Description	Step 1	Step 2	Step 3	Step 4	Step 5
▱ ◓🟡🟢🟢🟢	First battery indication LED is blinking every 30 seconds.	Batterypack communication is lost. Check if loss of functionality is acceptable.*	Reconnect the Batterypack connector in C2 of esense Controller Box.	☒ Batterypack		
▱ 🟠🟡⚪⚪⚪ --✗→	Charge indication is not started at connection of charger or mains cable.	Check if Batterypack communication is available. *	Check the color of the indication LED on the charger. **	☒ Mains cable to charger. (In case charger remains switched off)	☒ Charger. (In case charger remains switched off or error indication persists.	☒ Batterypack
▱ 🟠🟡🟢🟢🟢 --→	Charge indication remains active after disconnection of charger or mains cable.	Make sure the charger is disconnected from the mains.	☒ Batterypack			
▱ ◓⚪⚪⚪⚪	First battery LED is blinking and a beep sounds every 10 seconds.	Recharge the Batterypack.				

* Communication between the Batterypack and the esense Controller Box is used for various reasons:
- Switch off of drive functionality during charging.
- Precise display of battery charge level (When not available a less precise display method is used).
- Display of charge indication.
- Display of battery values and settings in PowerTalk.

In case these features are not considered essential, the situation may be left as is.
Lost Batterypack communication may be restored by the manufacturer. Contact Indes for details.

** The LED on the charger communicates a number of states. Most colors indicate standard charge process states, but some may indicate faults.

Indication	Meaning	Possible charger fault
Off	Charger broken or not connected to mains.	Yes
Yellow	No battery connected or shortly getting ready to start charging.	
Orange	Fast charge	
Green/ yellow	Top-off charge	
Green	Trickle charge (Battery full)	
Orange/ green	Error	Yes

4   Distribution and authorization list

Author	Department	Date	Approval
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5   Revision list

Revision	Definition	Date
1.00	First release.	20171127
2.00	Log entry reference table added, reference to fit with FW 1.01.05, minor changes in troubleshooting steps.	20180516
3.00	Updated Pushbar fault troubleshoot steps and explanations. Updated PowerTalk Log file paragraph	20181001
4.00	Added additional info on battery troubleshooting	20181010
5.00	Correction reference section 2.2, added esense Up remarks, added additional troubleshooting on grounding.	20200109

6   esense documentation

Article overview
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Installation and service manual
E1409_yyyymmdd_esense 9000 installation and service manual_rx.yy

User manual
E1409_yyyymmdd_esense 9000 use manual_rx.yy

Troubleshoot guide
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Parameter list
E1409_yyyymmdd_esense parameter list_rx.yy

All documentation is available in English at esense-moves.com/documentation9000.
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