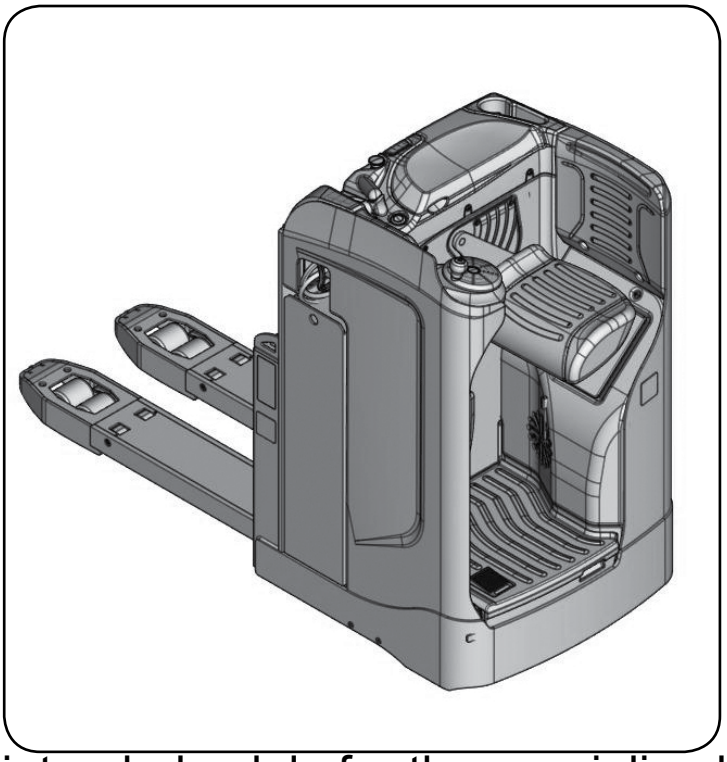
Part no.: **550128451** Overhaul: **2 (03/2020)**

Technical information for Yale service centres



This manual is intended solely for the specialized technicians of the Yale service network.

C854...

MP20T
MP25T

SECTION CONTENTS

INSTALLATION AND SETTINGS

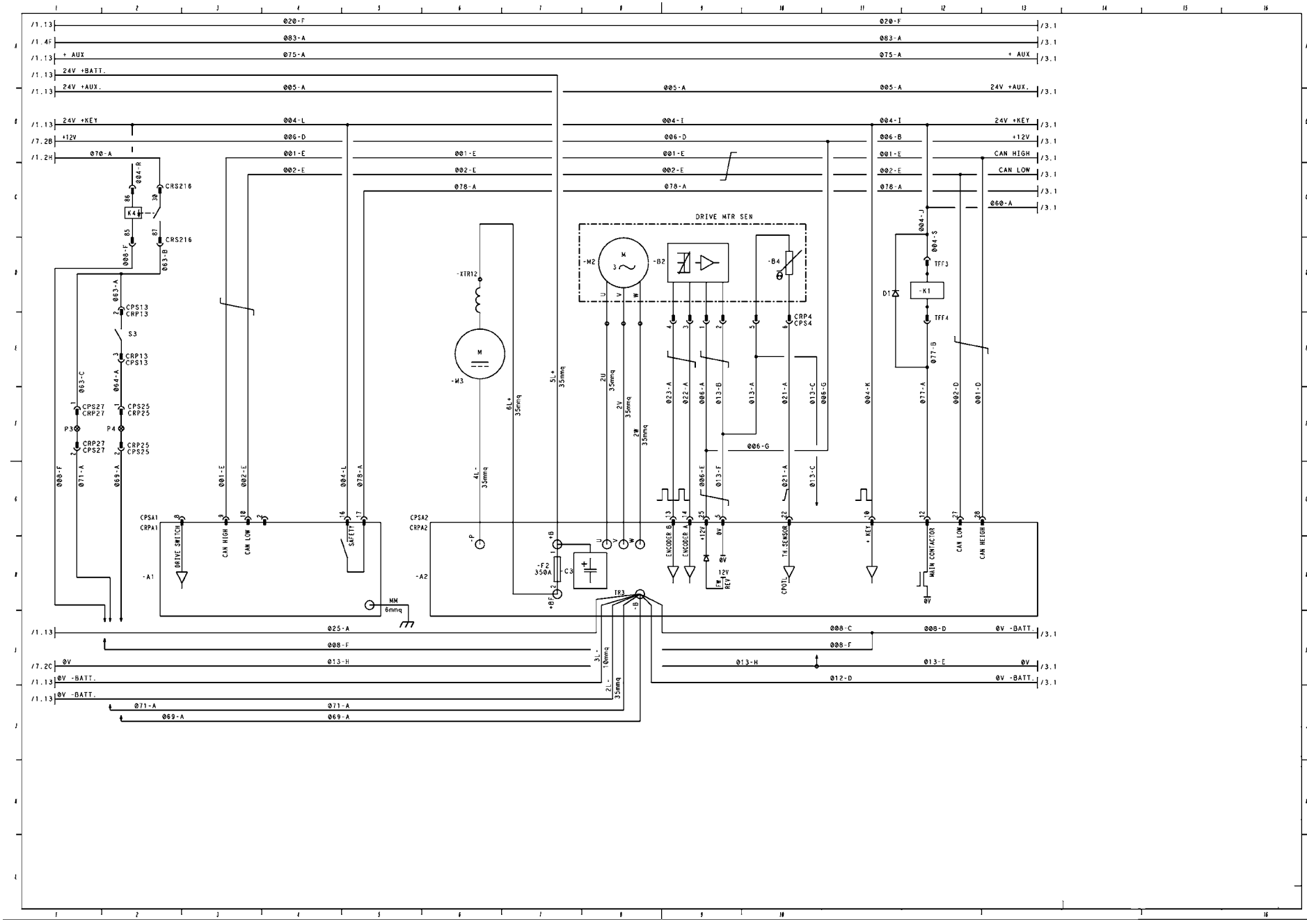
DIAGNOSTICS AND MEASUREMENTS

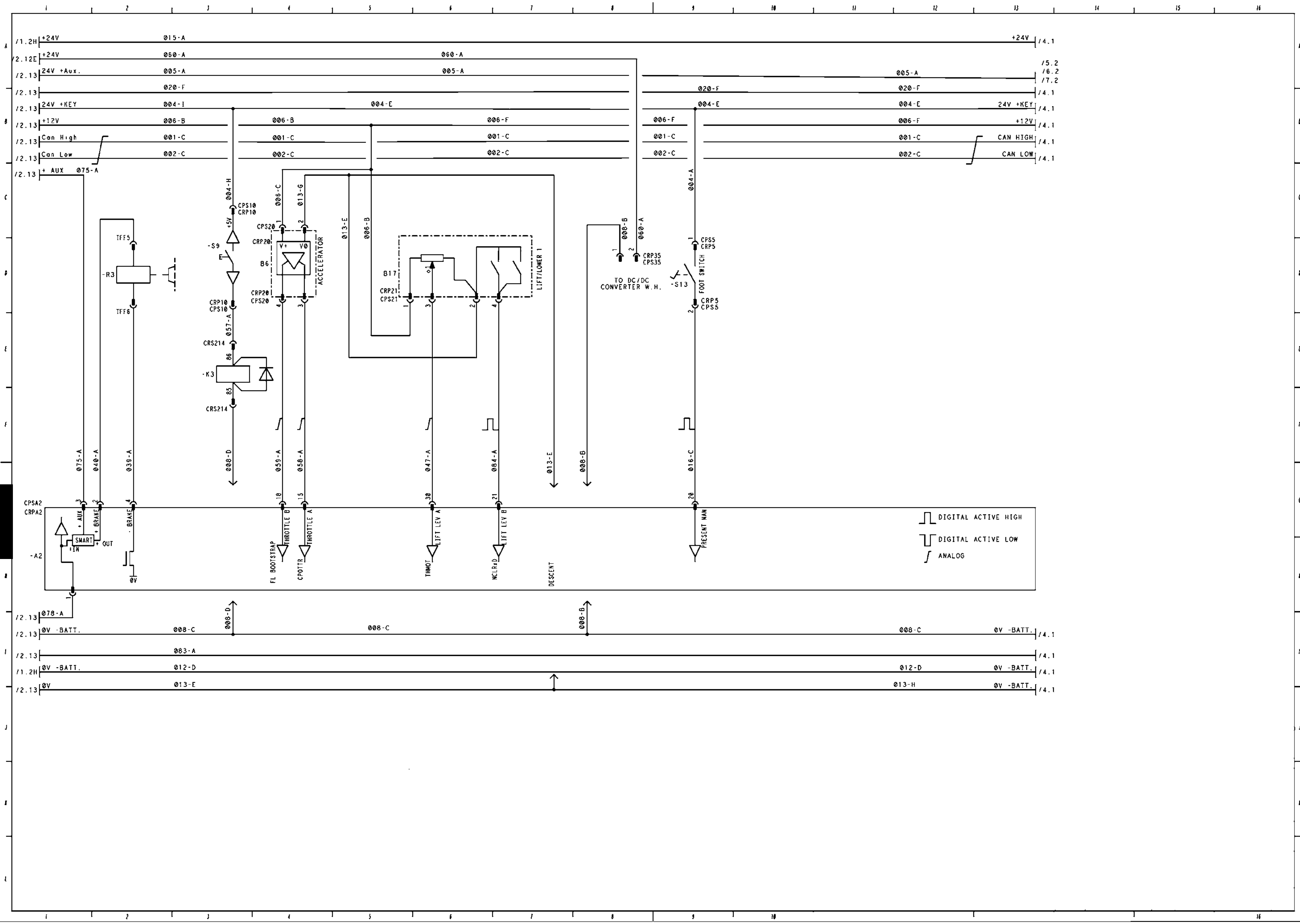
PARAMETER	measurement unit
AUTOMATIC REQ.	ON/OFF
It signals whether the EPS controller follows the manual control (OFF) or is performing alignment on Automatic (ON)	
MM ALARM SWITCH	ON/OFF
It is ON when the safety contact belonging to the main microprocessor is closed.	
SM ALARM SWITCH	ON/OFF
It is ON when the safety contact belonging to the secondary microprocessor is closed	
TRUCK MOVING	ON/OFF
It gives the status of the CNA 1 input, when it is ON it means there is a request for aisle presence	
HIGH RESOL AD	ON/OFF
It becomes ON when the set point potentiometer is processed with a high resolution AD	
SLOPE PEAK	NUMBER
This reading is used to debug the max gradient of the connected potentiometers, especially when in a reduced configuration of feedback sensors	
READ FBPT AT SW1	Volts
Potentiometer value when it switches to CW NOT USED	
TRUCK SPEED	%
Value expressed as a percentage of the traction speed It is used for the dynamic numbness (the steering sensitivity is reduced when the traction speed increases)	
STEER ANGLE	°
Drive wheel angle measured compared to rest position (0°)	
SUM SP POTS	mV
Value acquired by the two control potentiometers.	
SUM FB POTS	mV
Value acquired by the two feedback potentiometers.	

Alarm	Code MDI	Troubleshooting
POWER MOS SHORT	**89**	This kind of failure is not connected to external components; Replace the module.
Cause: Before closing the remote-control switch, the software checks the power section: it turns on the Mosfets alternatively and waits until the phase voltage drops down to -BATT. If the voltage of the phases does not follow the commands, this alarm appears.		
SAFETY FEEDBACK	**91**	If the alarm appears, then the problem is inside the module. Replace the module.
Cause: Problems on the hardware circuits which manage the guard against the main remote control switch and electromagnetic brake short circuit.		
CURRENT GAIN	**92**	Contact the Zapi service unit to carry out the correct adjustment procedure for the current gain parameters, or replace the module.
Cause: The gain parameters of maximum current have default values, therefore the adjustment procedure of the maximum current has not yet been performed		
NONE	**94**	Wait that the synchronization is completed.
Cause: This alarm appears when the MDI display and the traction are synchronizing the hourmeter.		
MOTOR STALLED	**95**	Check the electrical and mechanical functionality of the encoder
Cause: The frequency read by the encoder does not increase during acceleration. There has probably been a failure on the encoder (for instance one or two encoder channels corrupted or disconnected).		
ANALOG INPUT	**96**	If the problem appears regularly, the module needs replacing.
Cause: The analog/digital conversion has returned a negative value on all the signals converted for more than 400 msec. The aim of this diagnosis is to find a fault in the A//D converter or a problem in the code that omits the updating of the conversion of the analog signal.		
SLIP PROFILE	**99**	Contact the Zapi service unit to carry out a check on the deviation parameter values of the current gain, or replace the module.
Cause: The deviation parameters of the hardware setting menu are not correct.		

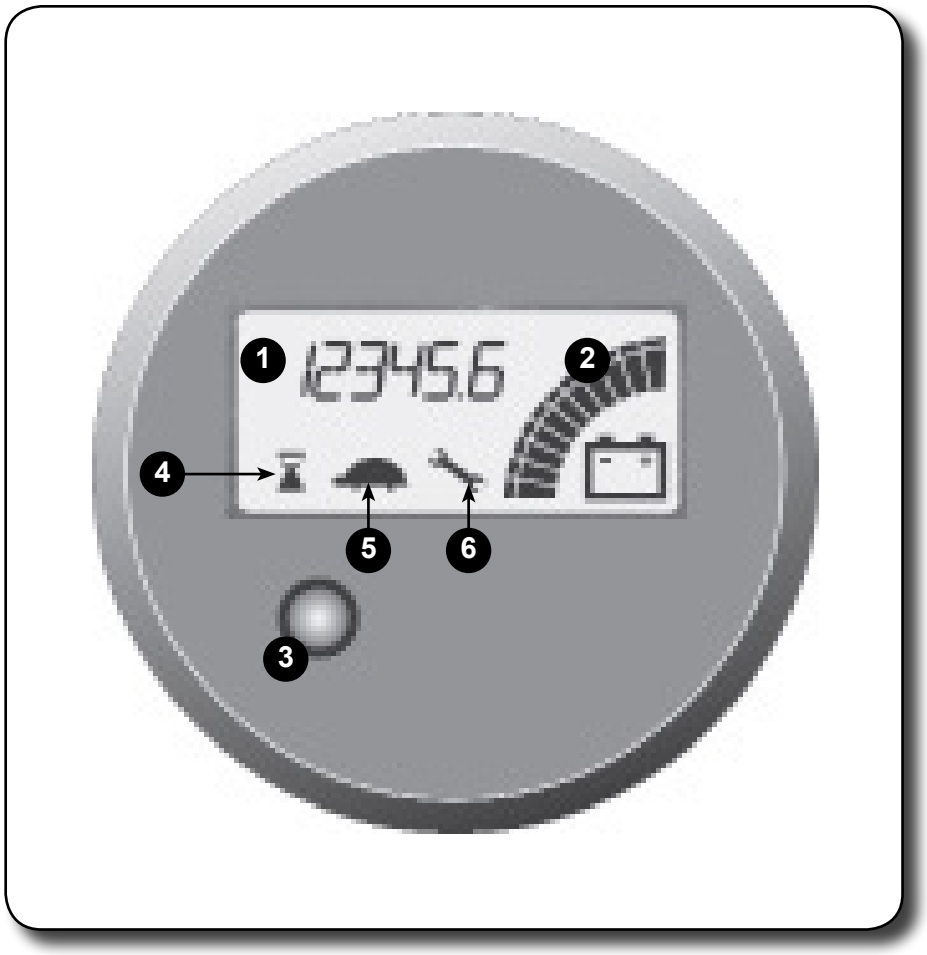
Alarms	Code MDI	Troubleshooting
GAIN EEPROM KO	**27**	Carry out a clear eepron on the EPS module. If the alarm persists, the module needs replacing.
Cause: The parameters defining the current amplifiers gains (default) are recorded in a permanent memory: each value is recorded in three different memory cells. The alarm appears if the values in the three memory cells are not identical.		
CAN BUS KO	**28**	Check the CAN BUS line and any false contacts on the related pins.
Cause: This warning appears when the EPS does not receive communication via CAN BUS for more than 1 second.		
CHECK FB POT	**31**	Insert the “WHEEL PT CHECKED” paramenter on ON and turn the key to OFF to reset the alarm.
Cause: This alarm occurs when: the feedback potentiometer exceeds 0.2 V the "SET MIN FB POT" or "SET MAX FB POT" value.		
FB POT LOCKED 2	**34**	Check the steering motor connections.
Cause: This alarm occurs when the connections of the motor phases are inverted.		
DEFAULT POT SUM	**35**	To acquire the sum of the feedback potentiometer set the SUM POTS CAL parameter on ON and reset the truck.
Cause: This alarm occurs if the sum of feedback potentiometers signals has not been acquired.		
POSITION ERROR	**38**	Acquire again the sum of the feedback potentiometer setting the SUM POTS CAL parameter on ON and resetting the truck.
Cause: This alarm occurs if the value of the sum of the two feedback potentiometers signals is 0.3V different from the acquired sum.		
SERIAL ERROR #1	**39**	The module must be replaced.
Cause: The main microprocessor and the secondary microprocessor communicate via a local serial interface. This alarm occurs when the secondary microprocessor does not receive communication from the main microprocessor through the serial interface.		
MICRO SLAVE #4	**40**	The module must be replaced.
Cause: This alarm occurs if the secondary microprocessor detects that the wheel motor field is located in the opposite direction relative to the position set (RTC version and self-centering)		
SLAVE COM. ERROR	**41**	The module must be replaced.
Cause: The main microprocessor and the secondary microprocessor communicate via a local serial interface. This alarm occurs when the main microprocessor does not receive communication from the secondary microprocessor through the serial interface.		

Alarm	Code MDI	Troubleshooting
MOTOR TEMPERAT.	**48**	• Check that the parameter DIAG MOTOR TEMP is correct • Check that the motor temperature sensor functions correctly and replace it if necessary. • If the sensor is working correctly, improve the motor cooling system.
Cause: This alarm occurs only when DIAG MOTOR TEMP has a value other than 0 and the temperature sensor inside the motor detects a temperature greater than 120°C. This alarm also appears on attempting to acquire the motor resistance when the motor temperature exceeds 120° (always with DIAG MOTOR TEMP other 0).		
MOTOR LOCKED	**49**	• Check that motor rotates easily and is not mechanically obstructed. • If the motor is OK, check the motor encoder or the connections between the encoder and the EPS.
Cause: This alarm appears when the motor current remains greater than 90% Imax for more then 1 sec, when the traction speed is greater than 15% (the delay time changes to 5 sec. when the traction speed is less than 5%).		
ENC1 VS.ENC2 ERR	**50**	Test the encoder as follows: • Leave the steering in neutral position and record the Enc Counting and Enc 2 Counting values. • Turn the wheel through 90°; encoder 1 should be at ±8000 and encoder 2 at ±130.
Cause: This alarm occurs when the speeds measured by encoder 1 and encoder 2 do not correspond with each other.		
WRONG RAM MEM.	**51**	• If the alarm persists, replace the control.
Cause: This alarm occurs when there is an error data written to the RAM.		
CAN BUS KO M/S	**52**	• Switch the truck off and then back on. • If the alarm persists, replace the control.
Cause: The master microcontroller and the slave microcontroller communicate via a CAN bus in the control. This alarm appears if no reply is received for more than 100 ms.		
PARAM RESTORE	**53**	• Switch the truck off and then back on.
Cause: This message confirms that the 'Clear Eeprom' procedure has been executed correctly.		


DRIVE MTR SEN
-M2
-B2
-B4
-M3
-XTR12
-K1
-F2
350A
-C3
-A1
-A2
DRIVE SWITCH
CAN HIGH
CAN LOW
SAFETY
ENCODER B
ENCODER A
TH.SENSOR
+ KEY
MAIN CONTACTOR
CAN LOW
CAN HEIGH
24V +KEY
+12V
24V +AUX.
+ AUX
24V +BATT.
CAN HIGH
CAN LOW
0V -BATT.
0V


+24V
015-A
+24V
060-A
24V +Aux.
005-A
020-F
24V +KEY
004-I
004-E
+12V
006-B
006-F
Can High
001-C
Can Low
002-C
+ AUX
075-A
CAN HIGH
CAN LOW
ACCELERATOR
LIFT/LOWER 1
TO DC/DC CONVERTER W.H.
FOOT SWITCH
-S9
-S13
-R3
-K3
B6
B17
-A2
SMART
THROTTLE B
THROTTLE A
LIFT LEV A
LIFT LEV B
PRESENT MAN
FL BOOTSTRAP
CPOTTR
THMOT
NCLRxD
DESCENT
DIGITAL ACTIVE HIGH
DIGITAL ACTIVE LOW
ANALOG
0V -BATT.
008-C
083-A
012-D
0V
013-E
013-H

MDI DISPLAY

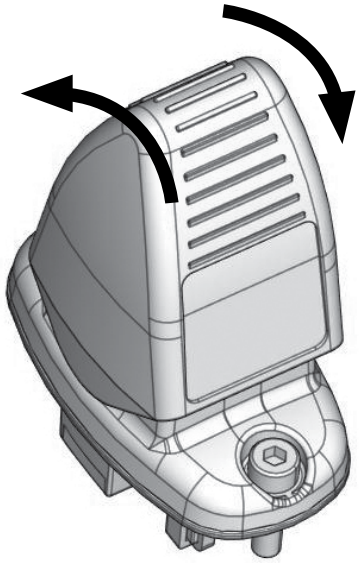


Ref.	Description
1	Total operating hours and alarms indicator
2	Battery charge level indicator
3	Light emitting diode - LED in warning state
4	Hour meter
5	Speed reduction status indicator
6	Programmed maintenance and warning status indicator

FORK LIFTING/LOWERING

CONTROLS

To lift or lower the forks use the dedicated up and down lever.



Devices involved	status	Wiring diagram ref.
Keyswitch	ON	S2
Emergency switch	ON	S1
Forks up/down lever	Active lifting/lowering button	
Man on the machine pedal	ON	S13

CONFIGURATION PARAMETERS

	Parameter Change menu	Set Model menu
AC1 PUMP	Pu acceler delay Pu deceler delay Lift speed Lower speed Init. lift speed Init. lower speed Creep speed Min evp Max evp Max evp 2 Evp acc forks Evp dec forks The legs max time	Model Type

For the standard values of each individual parameter, see the paragraph "STANDARD CONFIGURATION OF MODULE PARAMETERS". For a description of each individual parameter see "DESCRIPTION OF MODULE PARAMETERS".

EPS AC0 MODULE - VERSION WITH DUAL ENCODER

AC0 EPS / parameter change menu /
AC0 EPS / set options menu /
AC0 EPS / set model menu /
AC0 EPS / adjustment menu
AC0 EPS / special adjust. menu
AC0 EPS / hardware setting menu /

PARAMETER CHANGE MENU

PARAMETER	Default
SENS FILTER MSEC	20
POS. ACCURACY	83
SPEED LIMIT	Level = 6
SENSITIVITY	Level = 3
DT THRESHOLD	Level = 6
LAG FB REGULAT.	Level = 5
LEAD FB REGULAT.	Level = 0
AUXILIARY TIME	Level = 1
1ST ANGLE GAIN	90°
2ND ANGLE GAIN	90°

SET OPTIONS MENU

PARAMETER	Default
HOUR COUNTER	Running
AUTOMATION FUNCT	OFF
EPS REV STEER W.	OFF
DIAG MOTOR TEMP	OFF

SET MODEL MENU

PARAMETER	Default
CONNECTED TO	6
MODEL TYPE	0

ADJUSTMENTS MENU

PARAMETER	Default
SET STEER 0 POS.	3.18°

SPECIAL ADJUST. MENU

PARAMETER	Default
DEBUG OUTPUT	15
AUX FUNCTION 11	Level = 1

HARDWARE SETTING MENU

PARAMETER	Default
AUTOTEACHING	OFF
0-POS TEACHING	OFF

ADJUSTMENT MENU

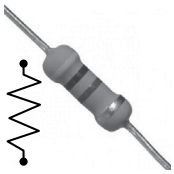
PARAMETER	min.	max.
AUX VOLTAGE #3	0	65535
This information is used as the tester value to debug the system		
ZERO SP POT	0V	5V
This parameter is used to perform the steering sensor acquisition.		
SET STEER 0-POS	1877	3127
This parameter is used to correct the centre position of the drive wheel.		
SET MIN FB POT	0V	5V
Minimum feedback potentiometer value.		
SET MAX FB POT	0V	5V
Maximum feedback potentiometer value.		
INF LIM FB POT	0 V	4875 V
Minimum limit of the feedback potentiometer beyond which the OVER ROTATION alarm is triggered.		
SUP LIM FB POT	0 V	4875 V
Maximum limit of the feedback potentiometer beyond which the OVER ROTATION alarm is triggered		
SUM POTS CALIBR.	ON	
	OFF	
This parameter is used to acquire the sum of the signals of the feedback potentiometer.		
ANTIROLLBACK FUN	ON	
	OFF	
It activates a current to keep the steering wheel in position when the truck is in motion		
WHEEL PT CHECKED	ON	
	OFF	
Lock/release of traction after the OVER ROTATION alarm (if set to OFF the CHECK FB POT alarm will appear).		

REPLACEMENT OF MODULES

REPLACING THE "COMBI AC1" MODULE

Equipment and tools

5 mm T-handle hex spanner



100Ohm resistor 25W insulated

13 mm hex socket wrench

ratchet

Procedure

Before starting work, ensure that you are wearing suitable protective clothing.
Move the carriage to a safe place, away from areas of transit of other vehicles and all pedestrians. Turn the keyswitch to OFF and disconnect the battery.

Phase 1

Carry out the DASHBOARDS REMOVAL procedure described in this chapter.

Phase 2

100 OHM 25 W RESISTOR

Connect the resistor between the positive **(B+)** and negative **(B-)** of the module **(fig.1)**. Wait approximately 10 seconds for the internal capacitors to lose their charge and then disconnect the resistence.

To avoid short circuit, it is important that the resistence is isolated.

If it is not possible to use an external resistor to run down the capacitors, it will be necessary to wait at least 90 seconds before disconnecting the power cables.

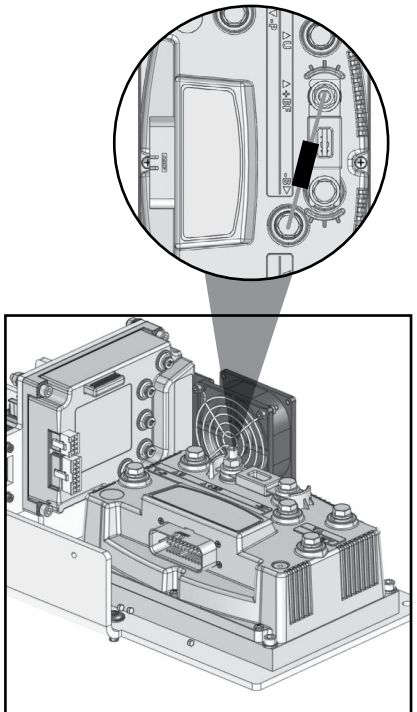


Fig. 1

REPLACEMENT OF ACCELERATOR SENSOR

Equipment and tools

4 mm Allen key

Procedure

Before starting work, ensure that you are wearing suitable protective clothing.
Move the carriage to a safe place, away from areas of transit of other vehicles and all pedestrians. Lower the forks to the ground, turn the keyswitch to OFF and disconnect the battery.

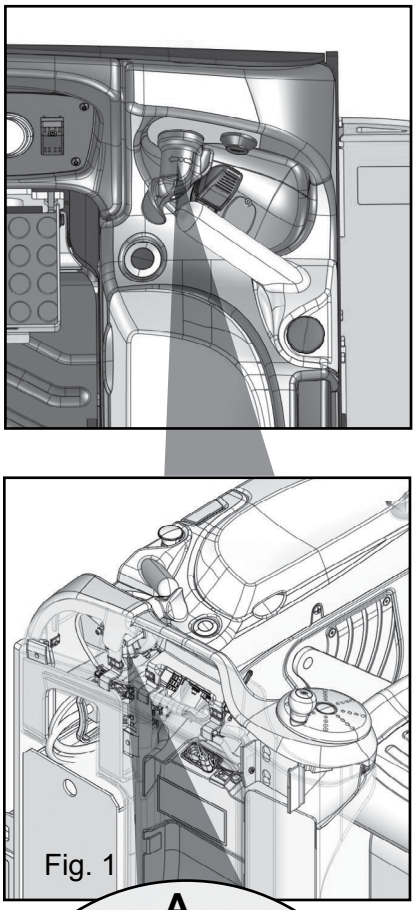
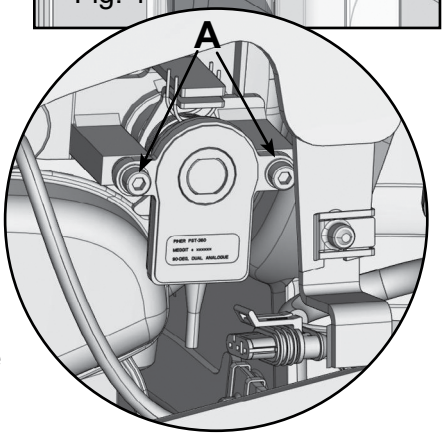


Fig. 1

Phase 1

Carry out the DASHBOARDS REMOVAL procedure described in this chapter.



Phase 2

4 MM ALLEN KEY
Once removed the dashboard that protects the electrical system turn it over to access the accelerator sensor. Disconnect the connector and with the 4 mm Allen wrench unscrew and remove the screws that secure the sensor **(ref.A fig.1)**.
Proceed with replacement **(fig.2)**.

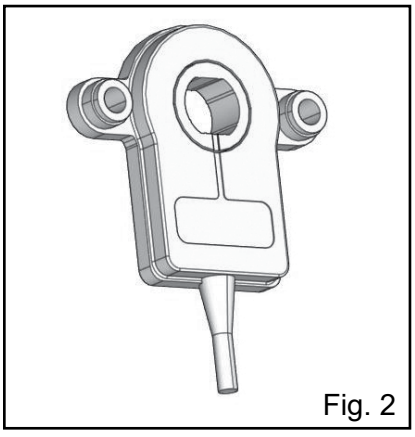


Fig. 2

REPLACING THE CLAMP MICROSWITCH

Equipment and tools

5 mm T-handle hex key

Procedure

Before starting work, ensure that you are wearing suitable protective clothing. Move the carriage to a safe place, away from areas of transit of other vehicles and all pedestrians. Lower the forks to the ground, turn the keyswitch to OFF and disconnect the battery.

Phase 1

5 MM HEXAGONAL "T" SECTION SPANNER

Using the “T” handle hex key, unscrew and remove the screws securing the cover **(ref.A fig.1)**. Remove the cover.

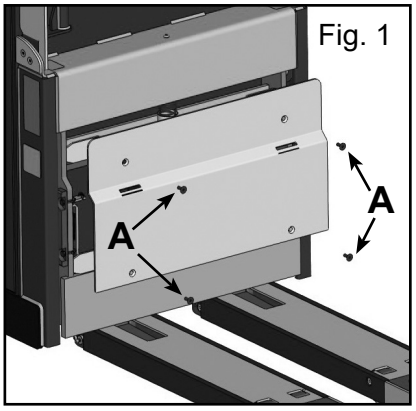


Fig. 1

Phase 2

5 MM HEXAGONAL "T" SECTION SPANNER

Before removing the microswitch, disconnect the connector (CRP28) in the motor compartment.

With the T-handle hex spanner, unscrew and remove the screws securing the switch holder bracket **(ref.B fig.2)**. Remove the bracket assembly

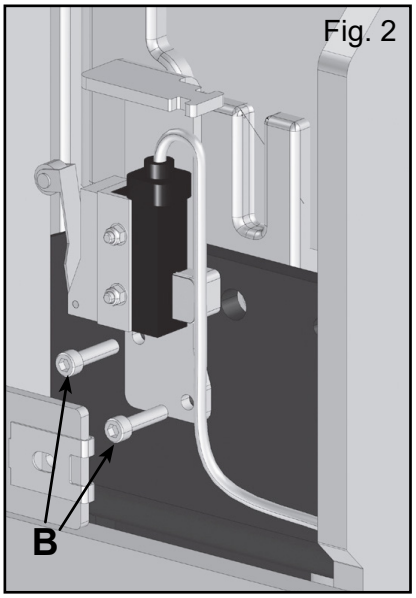
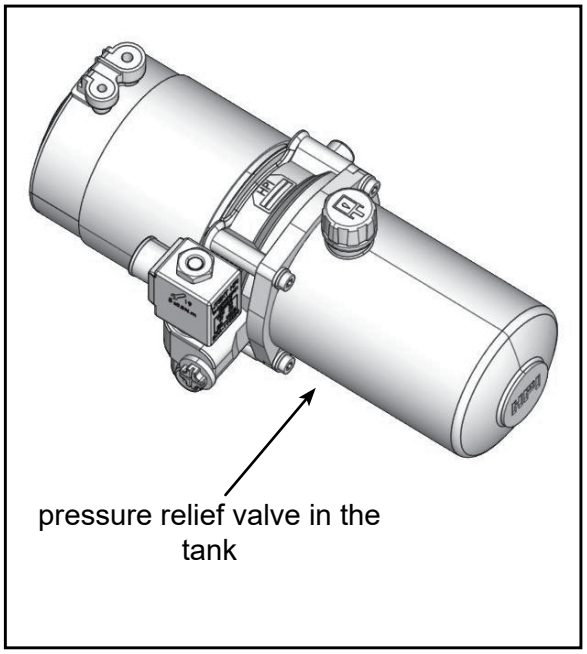


Fig. 2

HYDRAULIC DIAGRAMS FOR VARIOUS FUNCTIONS

- **Fork Lifting**
- **Fork Lowering**
- **Oil outlet through the pressure relief valve**



SOLENOID VALVE OPERATION CHART

Function	Pump	EV1
Fork Lifting	↻	-
Fork Lowering		✸
Oil release through the pressure relief valve	↻	-

↻ = pump in operation

✸ = solenoid valve coil powered

CYLINDERS

SINGLE ACTING CYLINDER

SINGLE acting cylinders receive and discharge the oil through a single pipe and the pressurised oil acts on just one side of the piston (single acting pushing cylinders) or on the flat face of the rod in the case of plunger type cylinders.

Single-acting plunger type cylinders

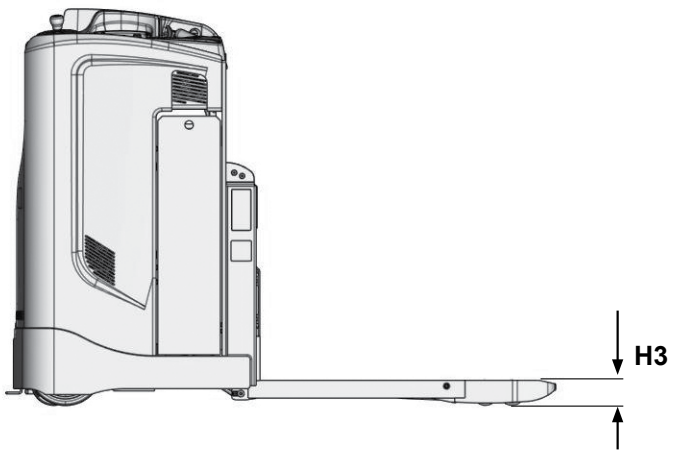
In this type of cylinder the piston is replaced by the flat end face of the piston rod or plunger; these cylinders are usually mounted vertically or in other positions in which the force of gravity returns the plunger to the rest position. Usually the diameter of the lower end of the rod is increased by a few millimetres in order to avoid it slipping out at the end of it's upstroke; this gives rise to a hydraulic damping effect during the last stages of the stroke which helps the slowing of the rod and avoids recoil on the upper end cap. Place in the latter, the necessary static sealing gaskets which avoid seepage of oil to the exterior.
In order to replace these gaskets one must unscrew the gasket case bushing.
Single acting cylinder with hollow rods differ in that before the lifting stroke begins the rod is also filled with oil. This solution is used on particularly tall masts to increase the resistance of the cylinders at the greater heights and make it possible to use smaller barrels and shafts.

Static and dynamic gaskets

The dynamic gaskets, assembled on the piston, avoid the seepage of the fluid from one barrel chamber to the next, the static gaskets, placed in the points where the parts meet (gasket case bushing - barrel) or between the sliding parts (shaft- chamber), avoid oil seepage from inside to outside.

LIFTING CYLINDER

Type of cylinder	Rod diameter mm	Height H3 mm
Type “A” with a simple push effect	50	120

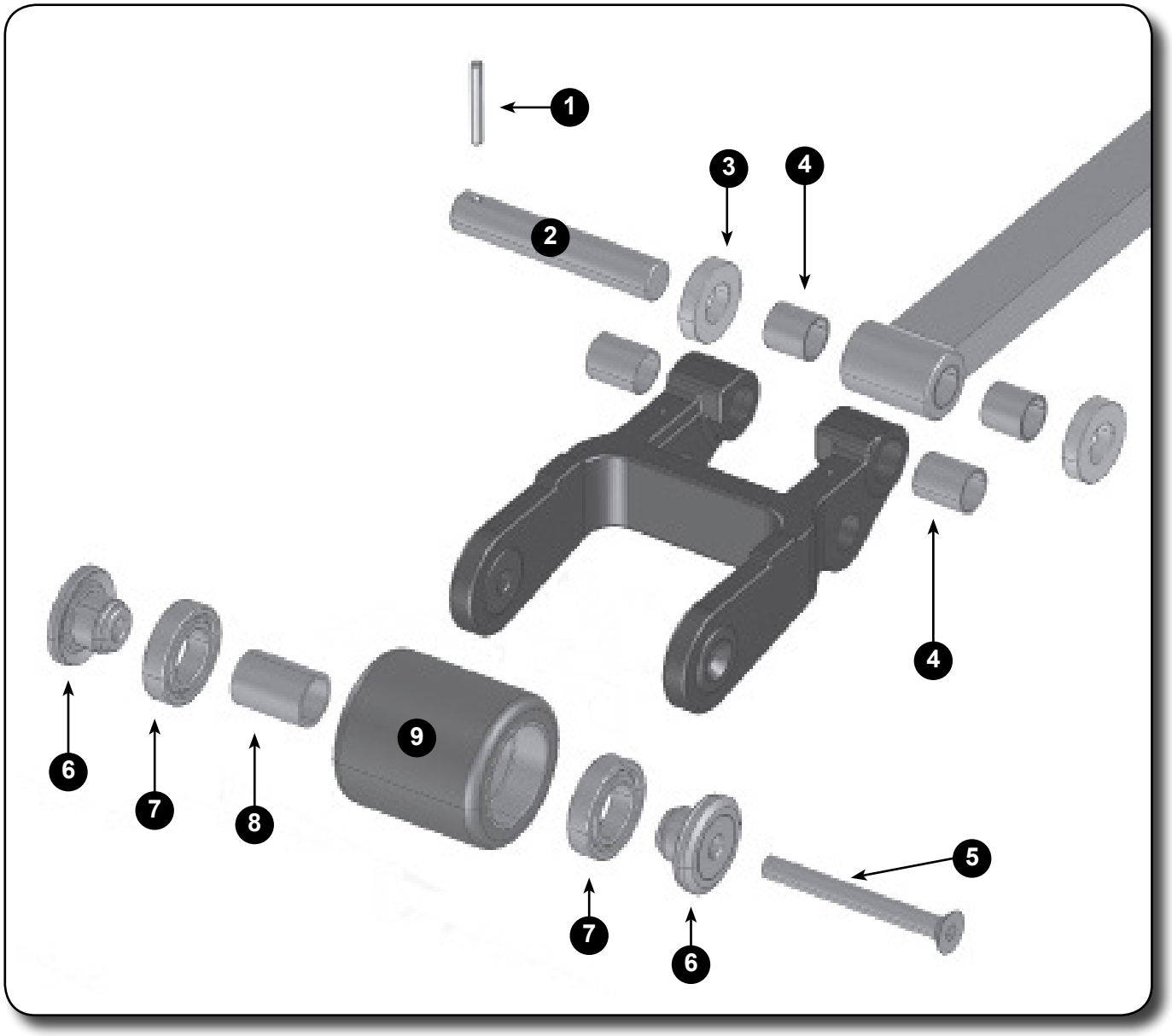


MECHANICS

LOAD WHEELS

IDENTIFICATION OF LOAD WHEEL COMPONENTS

SINGLE



Ref.	Description
1	Spring pin
2	Tie-rod pivot pin
3	Roller
4	Bush
5	Load wheel screw
6	Dust cover
7	Bearing
8	Spacer
9	Load wheel

STEERING FLYWHEEL DISASSEMBLY

Equipment and tools


extractor


cross-head screwdriver


3 mm “t” handle hex key


large flat blade screw-driver


7 mm open ended span-ner


external circlip pliers

Procedure

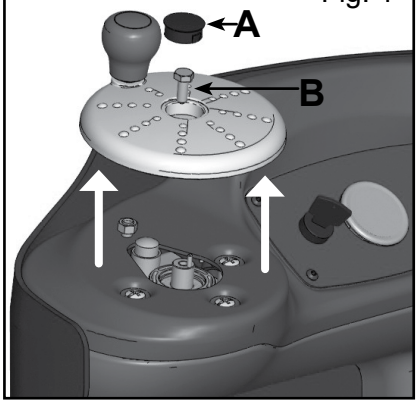
Before starting work, ensure that you are wearing suitable protective clothing.
Move the carriage to a safe place, away from areas of transit of other vehicles and all pedestrians. Lower the forks to the ground, position the key switch on OFF and disconnect the battery.

Phase 1

SOCKET WRENCH SIZE 13 mm

Remove the cap from the center of the flywheel **(ref. A fig.1)**, using a 13 mm socket wrench loosen the central screw **(ref. B fig.1)** and remove the flywheel pulling it upward.

Fig. 1

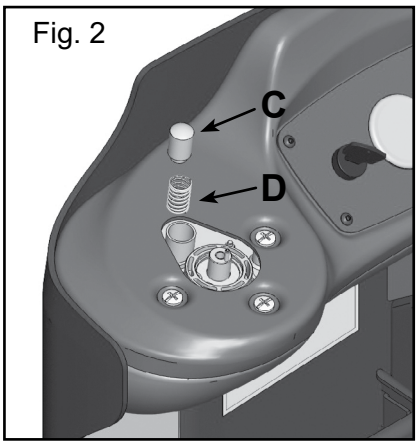


REPLACING THE SPRING BUFFER

Phase 2

Remove the buffer and the spring pulling them upward and proceed with replacement. (**ref.C/D fig.2)**.

Fig. 2



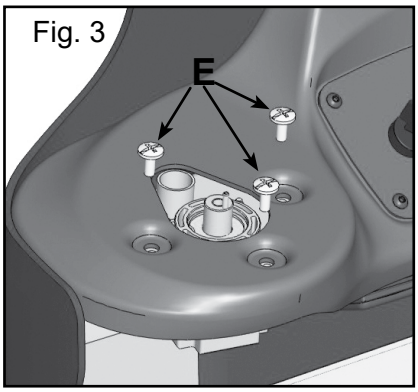
REPLACEMENT OF THE MOTOR

Phase 3

PHILIPS SCREWDRIVER

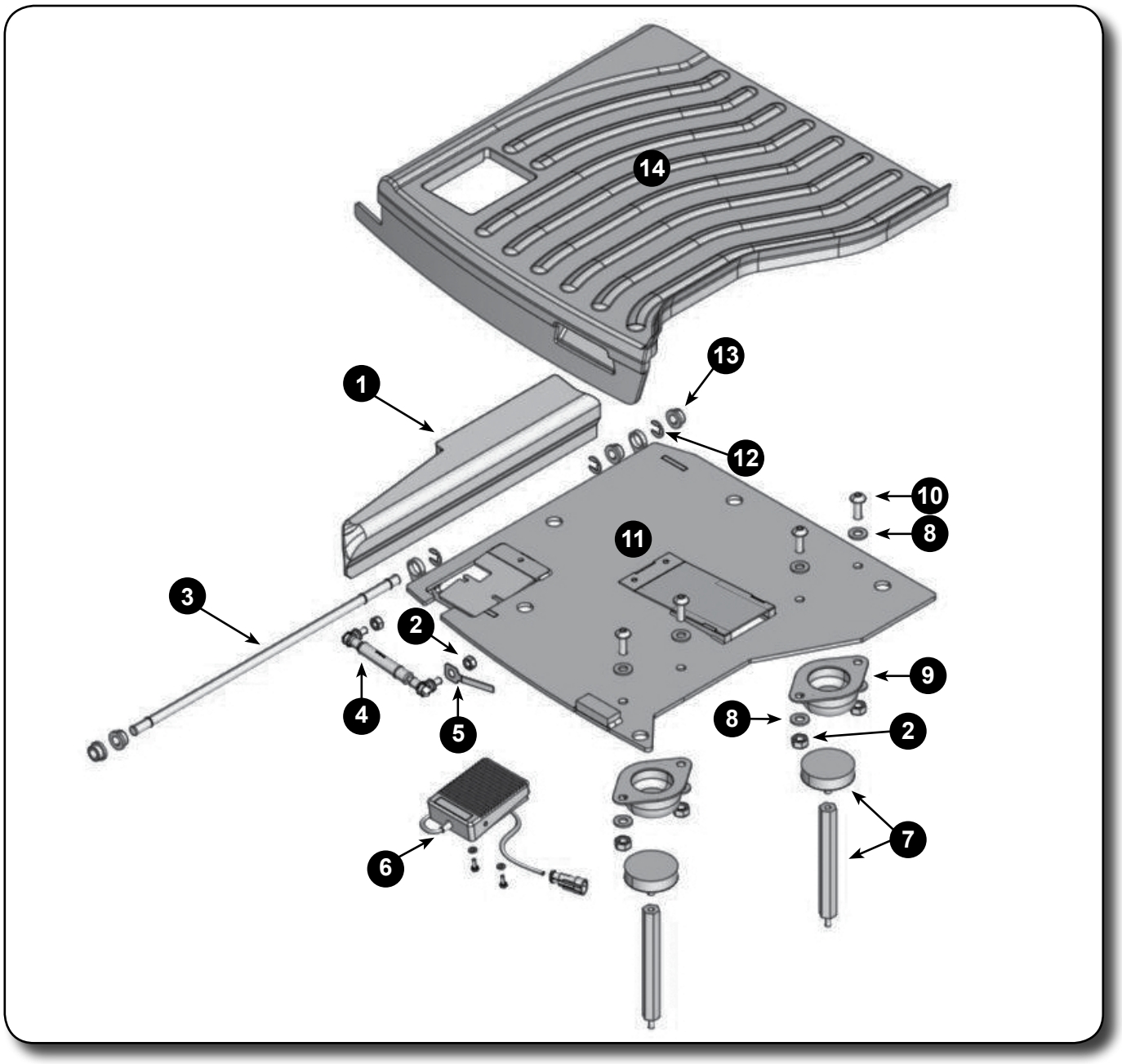
After removing the flywheel, loosen the three cross-head screws (**ref.E fig.3)**, to remove the plastic cover that covers the flywheel assembly.

Fig. 3



FOOTBOARD

KEY TO FOOTBOARD COMPONENTS



Ref.	Description
1	Lateral panel
2	Nut
3	Platform hinge
4	Gas cylinder
5	Plate
6	Pedal (man on board)
7	Platform support

Ref.	Description
8	Washer
9	Buffer
10	Screw
11	Platform plate
12	Clip
13	Bearing
14	Platform upper part

FORK SMALL MAST MECHANICS

REDUCER

Phase 3
5 MM “T” HANDLE HEX KEY
Remove the dust cover **(ref.F fig.3).**

Using the "T" handle hex key, unscrew the three screws securing the electromagnetic brake to the traction motor **(ref. G fig.4)**.

Disconnect the connector from the brake and pull it out it from the tab **(ref.H fig.5)**.

Remove the electromagnetic brake from the motor **(fig.5)**.

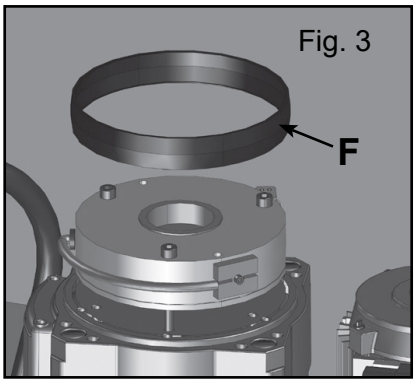


Fig. 3

Phase 3
ELASTIC RING OPENING PLIERS - EXTRACTOR
Extract the rotor **(ref.M fig.6)** from the pinion.
Using the circlip pliers, remove the circlip from the drive shaft **(ref.I fig.6)**.
Using the puller, remove the pinion **(ref.L fig.6)**.

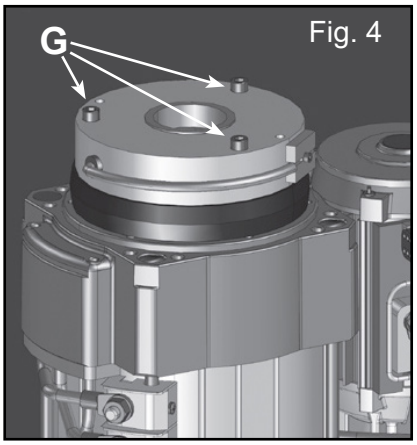


Fig. 4

INSTALLATION

After mounting the electromagnetic brake does not require adjustment. The tightening torque of the screws is 10 Nm.

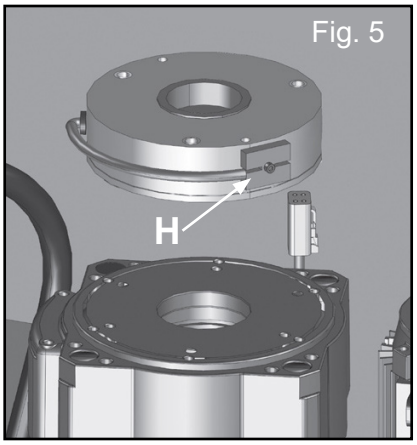


Fig. 5

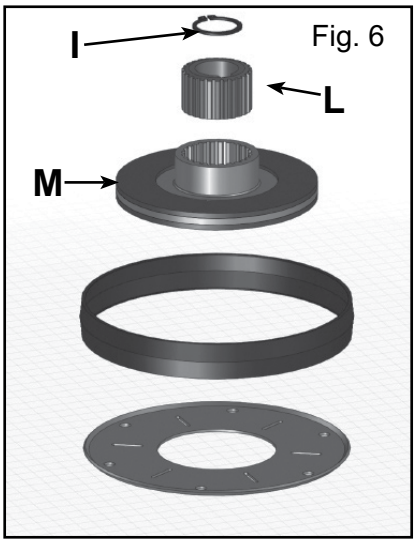
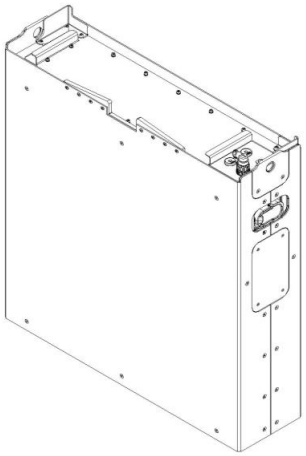
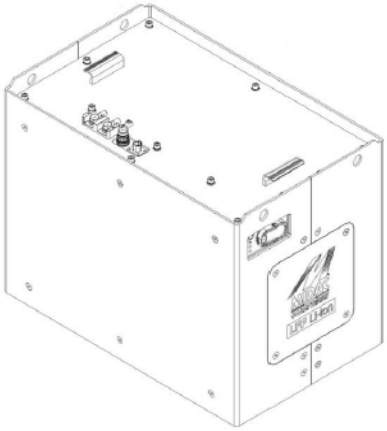


Fig. 6

Part n°: **550209262** **Rev. 1 (10/2019)**

Technical information for Yale service centres



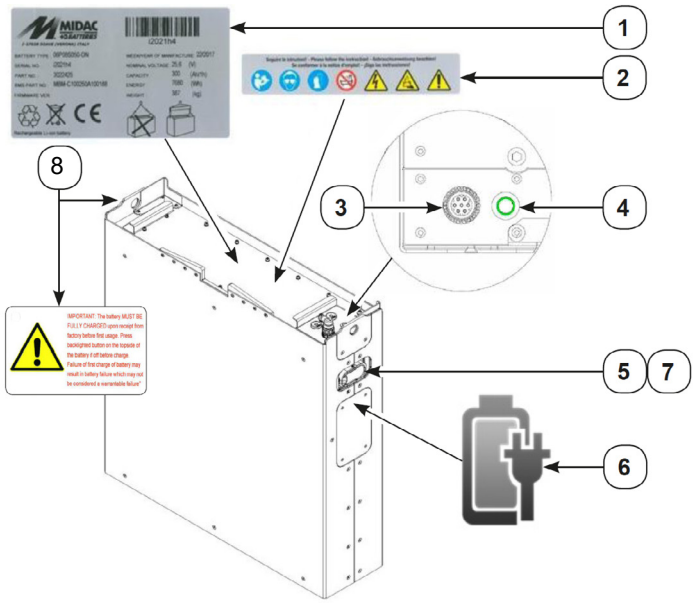


This document is intended solely for the specialized technicians of the Yale service network.

MIDAC Lithium Battery

E857	**MO20 - MO25 - MO20P - MO10L - MO50T - MO70T**
D849	**MR14 - MR16N - MR16 - MR16HD MR20 - MR20HD - MR25**
A428	**MP16 - MP18 - MP20 - MP22**
D843	**MP20X FBW - MP20X FBW FIXED**
D852	**MS10 - MS12 - MS14 - MS16 - MS20**
A942	**MR10E MR12E - MR14E**
C845	**MS10E - MS12E - MS24 HBE**
C854	**MP20T - MP25T**
C855	**MS16S**

D855



1	Data plate
2	Label with safety pictograms
3	Diagnosis connector
4	Activation button (backlit)
5	Charging connector
6	Charging connector label
7	Cover
8	First charge warning label

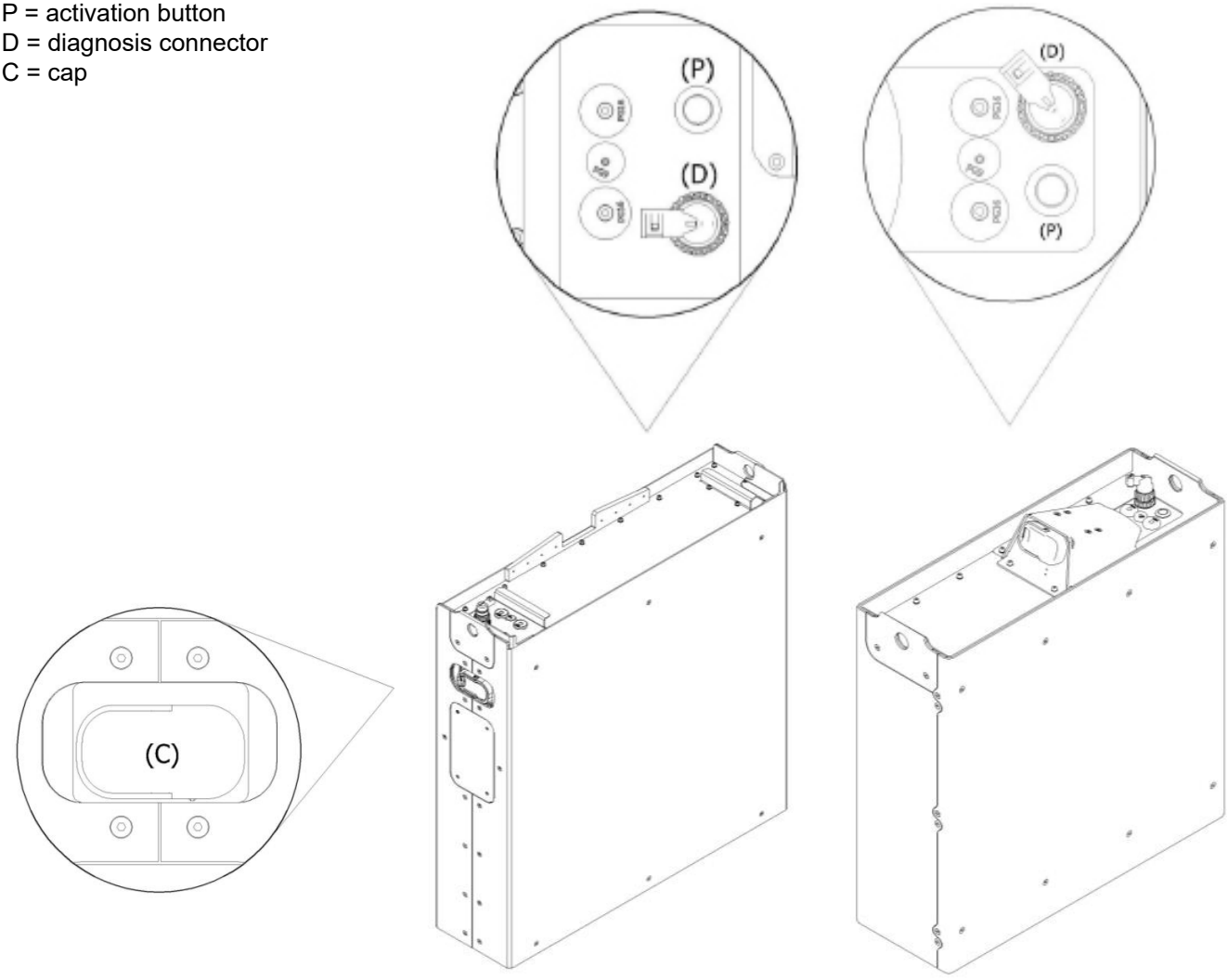
7.1 ACTIVATION OF THE BATTERY AND CHARGE LEVEL

The battery may be equipped with:
- activation button only
- activation button and battery status LED
- membrane keypad

Refer to the appropriate configuration.

Configuration with activation button only

P = activation button
D = diagnosis connector
C = cap



The battery can be activated/deactivated via the activation button “**P**”. The battery must be activated pressing for 1 second button “**P**” located on the top.
The battery can be deactivated by holding pressed for 3 seconds button “**P**”. Button “**P**” is equipped with a backlit ring that provides VISUAL FEEDBACK of the battery status.

8.0 ANOMALY AND MALFUNCTION MANAGEMENT

The battery is able to protect itself and put itself into a safe condition by opening the contactor the moment any anomalies are detected.
The opening of the contactor is managed by the BMS, in accordance with the requirements of the user, i.e. it is controlled by exchange of information over the CAN bus in order to safeguard the vehicle.
If the protection is activated by the BMS, 10 seconds after the opening of the contactor, the battery AUTO-DEACTIVATION procedure will start, and the battery will have to be re-activated.
Following the detection of an anomaly and subsequent AUTO-DEACTIVATION, try to re-activate that battery ONCE ONLY, and put it on charge.

If the problem persists, do not make any further attempts at MANUAL ACTIVATION, but contact MIDAC for assistance..

Do not open or attempt to repair the battery under any circumstances. Opening of the battery casing and all maintenance of lithium batteries are operations restricted EXCLUSIVELY to qualified MIDAC personnel.

9.0 NEW SETTINGS FOR USE OF LITHIUM BATTERIES

Trucks can be powered by either Lithium batteries or by Lead-Acid batteries, by setting the 2 new parameters accordingly, as described below.

Parameter	LI-ION batt.	Other batt.	Min	Max	Std
HYG LI-ION BATT	on	off			
BMS RED SPEED			0 %	70%	40 %

Parameter editing procedure for E857

The new parameters can be accessed in Traction Control > Set Option Menu:

Via PCST (Zapi CAN Console) to the CAN bus of the truck

a) Select the node Traction (2)

b) Select the Set option menu

c) Select HYG LI-ION BATT and set to ON for trucks equipped with lithium batteries, or otherwise set to OFF

d) Turn off and restart the truck.