TC 3000 SERIES
MAINTENANCE MANUAL

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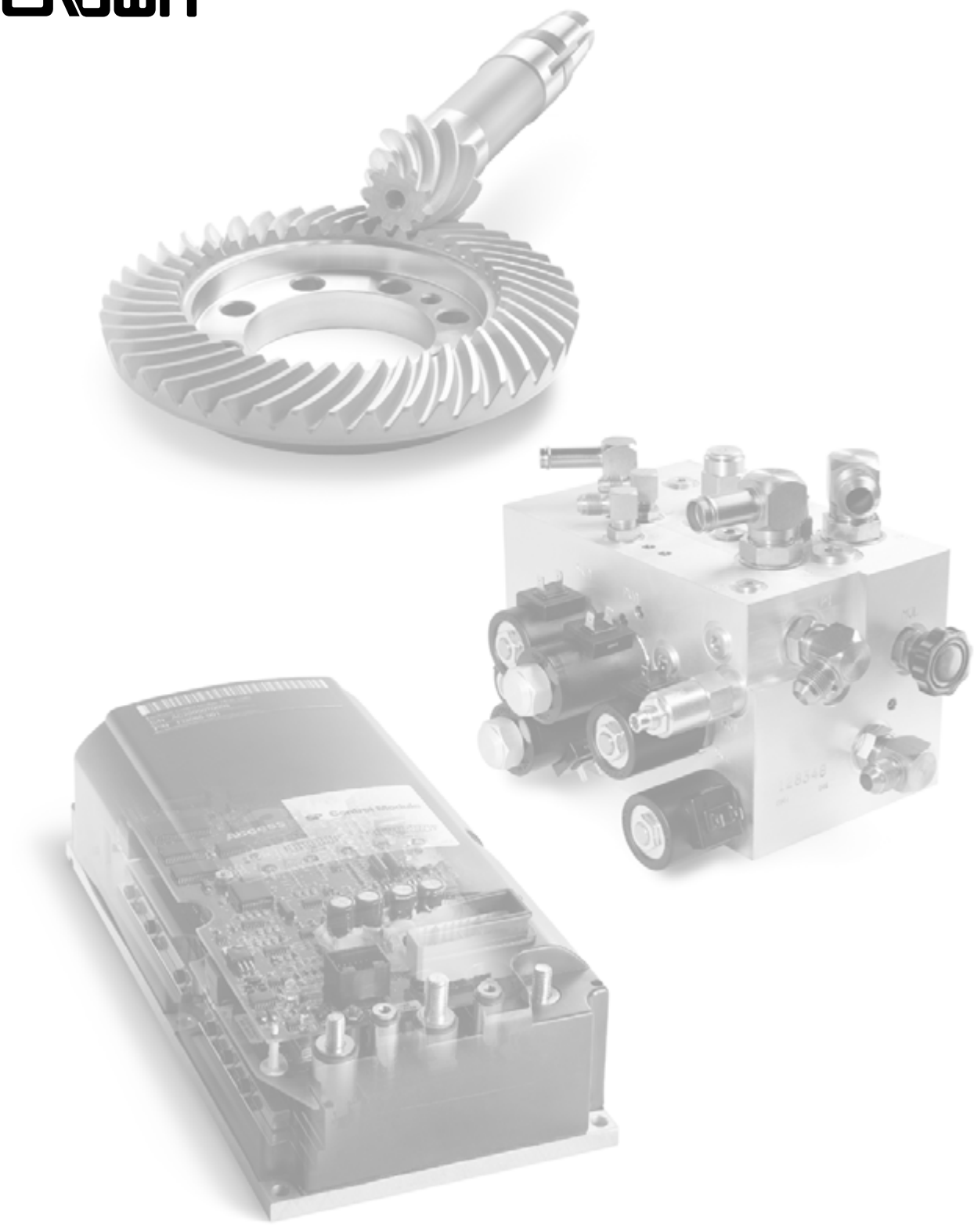

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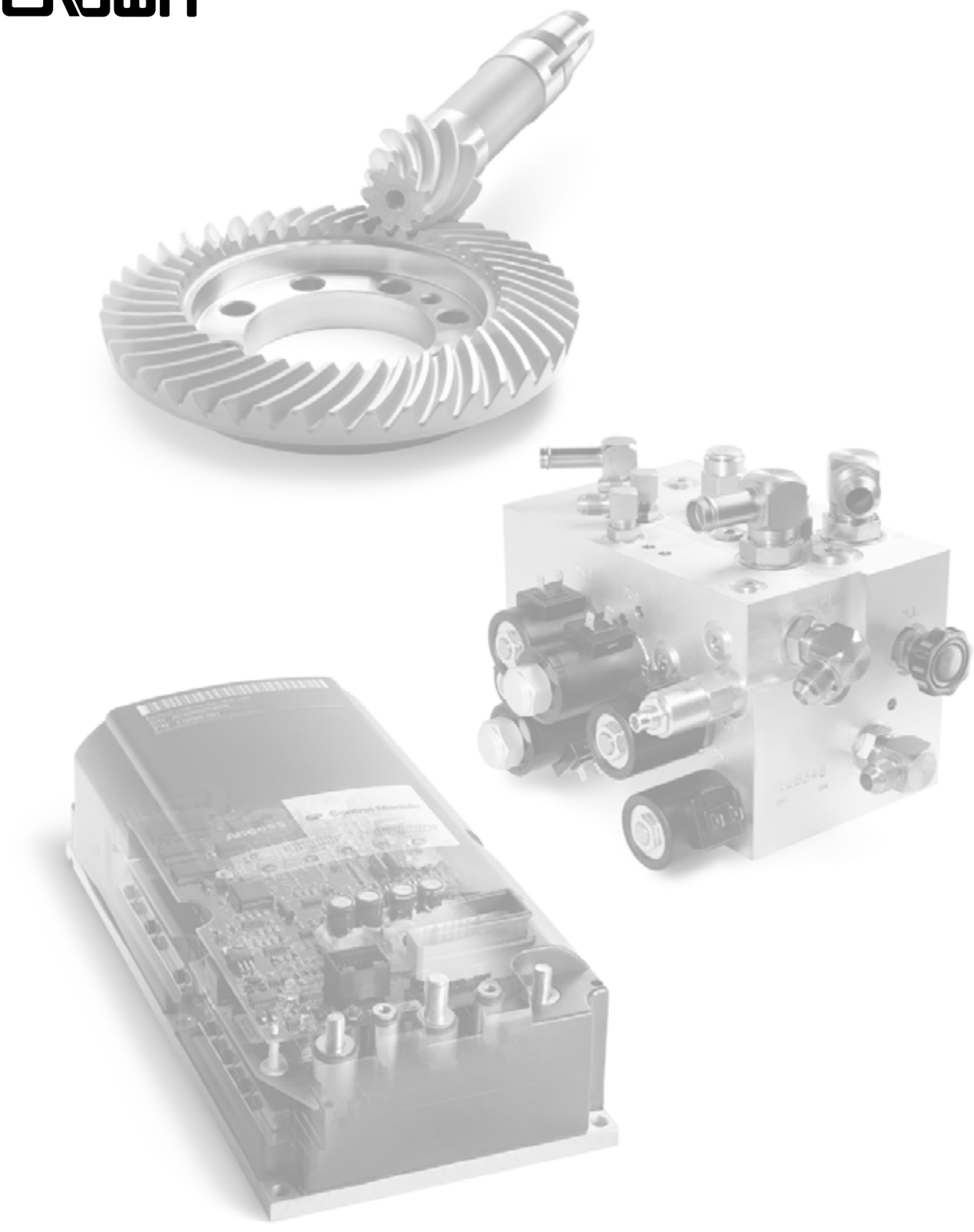


SAFETY

Notes:

Description of Symbols and Indicators

Safety Notices

The following symbols will help you to assess the risk to yourself, other people and materials should you fail to comply with a safety notice:

DANGER

This symbol warns of immediate danger to the life and health of personnel.
Severe injury or death will result.
Follow all instructions indicated by this symbol in order to avoid injury or death.

WARNING

This symbol warns of potential danger to the life and health of personnel.
Severe injury or death may result.
Follow all instructions indicated by this symbol in order to avoid injury or death.

CAUTION

This symbol warns of possible danger to the health of personnel.
Injury may result.
Follow all instructions indicated by this symbol in order to avoid injury.

NOTE

This heading warns of material damage and indicates additional information.

- This symbol denotes action to be taken to avoid risks.

Other indicators

1., 2., 3. denote work steps to be taken.

(1), (2), (3) etc. indicate item numbers in illustrations.

- This symbol denotes a list.

General Safety Instructions

Maintenance and Repair Instructions

WARNING

Observe the safety notices contained in the maintenance manual, the operator manual and on the truck. Failure to do so could result in serious or even fatal injuries to maintenance and other personnel.

Powered trucks can become hazardous if maintenance and service work are neglected. For this reason maintenance and inspections must be performed at sufficiently short intervals. There must be suitably trained personnel and proper guidelines at your place of work.

Maintenance and Repairs

- Work must be performed in accordance with these service instructions and relevant service bulletins.
- Maintenance and repair work must only be performed by qualified and authorized personnel.
- Keep fire protection equipment at hand and do not use a naked flame to check fluid levels or to test for leaks.
- Use groundwater neutral, non-flammable solvents for cleaning. Always perform cleaning work over an oil separator. Protect the electrical system against damp.
- Keep the work place and battery charging station clean, dry and well ventilated.
- Do not allow oils to penetrate the ground or the drainage system. Used oil must be recycled correctly. Oil filters and dehumidifying inserts must be treated as special waste. Observe the local authority regulations.
- Spilled battery fluid must be neutralized immediately and thoroughly rinsed.
- Keep the truck clean. This will facilitate tracing loose or faulty components.
- Maintain the legibility of the data capacity plate and data plate, warning and instruction decals.
- Truck modifications and additions may only be performed with Crown's prior written approval.
- The reliability, safety and suitability of Crown trucks can only be ensured by using original Crown parts.

Before Parking the Truck

- Apply the brake until the truck comes to rest.
- Apply the parking brake.
- Switch off the truck and remove the key.
- When parking on a slope or incline always chock all wheels.

Before Working on the Truck

- Raise the truck so that the drive wheel can turn freely.
- Apply the Emergency Disconnect and disconnect the battery.
- Prevent the truck from rolling away and lowering.
- Allow sufficient room for manoeuvre when testing the truck, to avoid endangering yourself and other people.

Before Starting the Truck

- Test the safety mechanisms.
- Get into the travel position.
- Test the travel direction switch, speed control, steering, warning mechanisms and brakes.

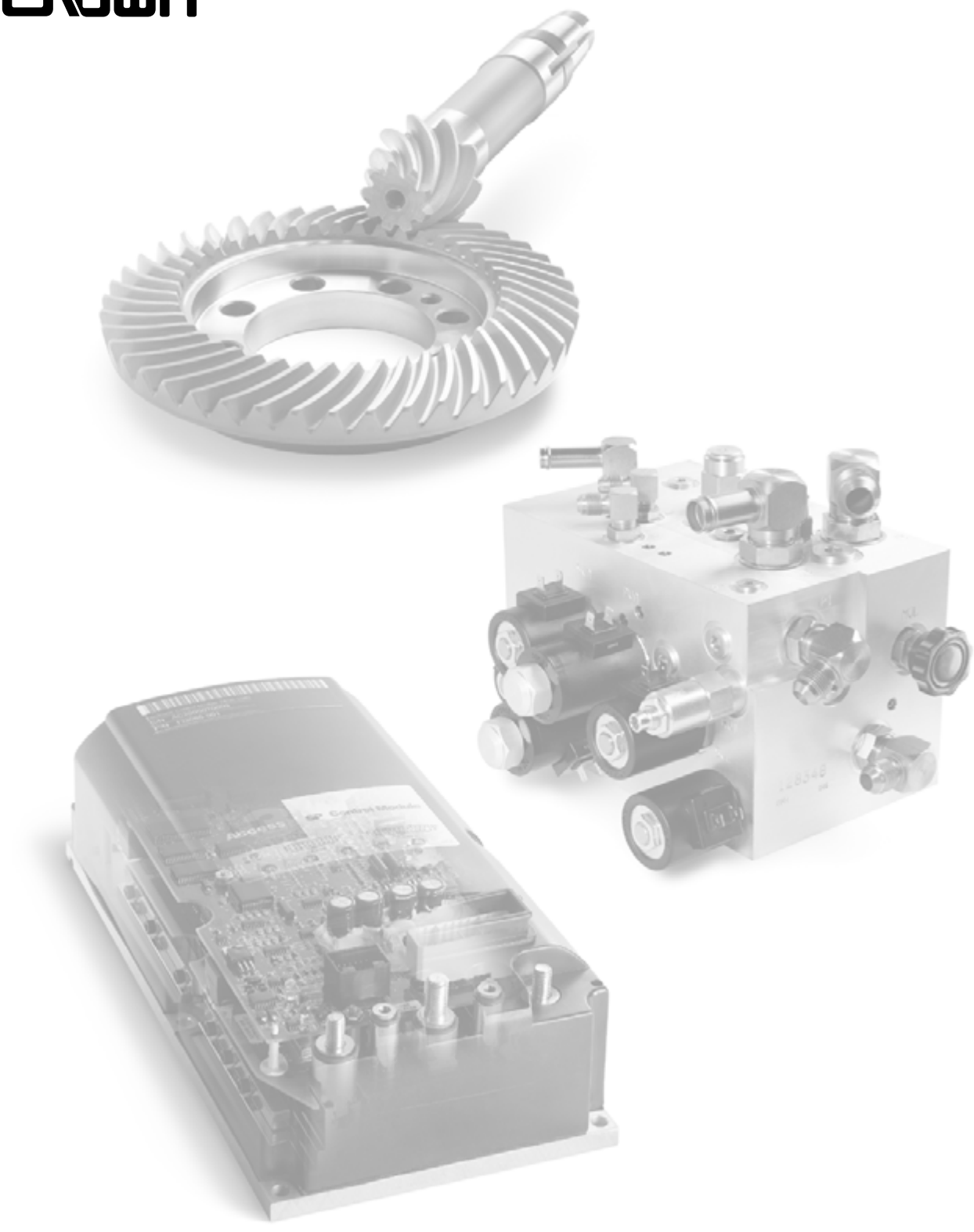
Warning and Instruction Decals on the Truck

In the course of periodic maintenance work, check that the warning and instruction decals on the truck are complete and legible.

- Clean any dirty decals.
- Replace any faulty or missing decals.

The spare parts manual gives details of the labelling and arrangement of the warning and instruction decals on the truck.

Notes:



INTRODUCTION

Notes:

General

INFORMATION

This manual is intended only for trained, specialist personnel who are authorised to carry out the operations described.

Service Training

Crown offers appropriate truck-related training for service personnel. For more information contact Crown's service department.

Replacement Parts

This manual does not contain a spare parts list. Replacement parts can be found in the spare parts catalog.

Additional Attachments and Modifications

WARNUNG

Untested modifications can lead to fatal accidents. *Any modification which alters the original condition of the truck requires prior testing and approval in writing by Crown (see contact address).*

- *The weight and position of attachments can have a significant affect on the capacity and other features of the truck.*
- *Modifications to the electrical system or the subsequent installation of electric-powered components can damage the truck.*

Using the Manual

Section
Table of Contents
Safety
Introduction
Lubrication & Adjustment
Drive Unit
Electrical System
Brake System
Steering
Platform
Schematic Diagrams

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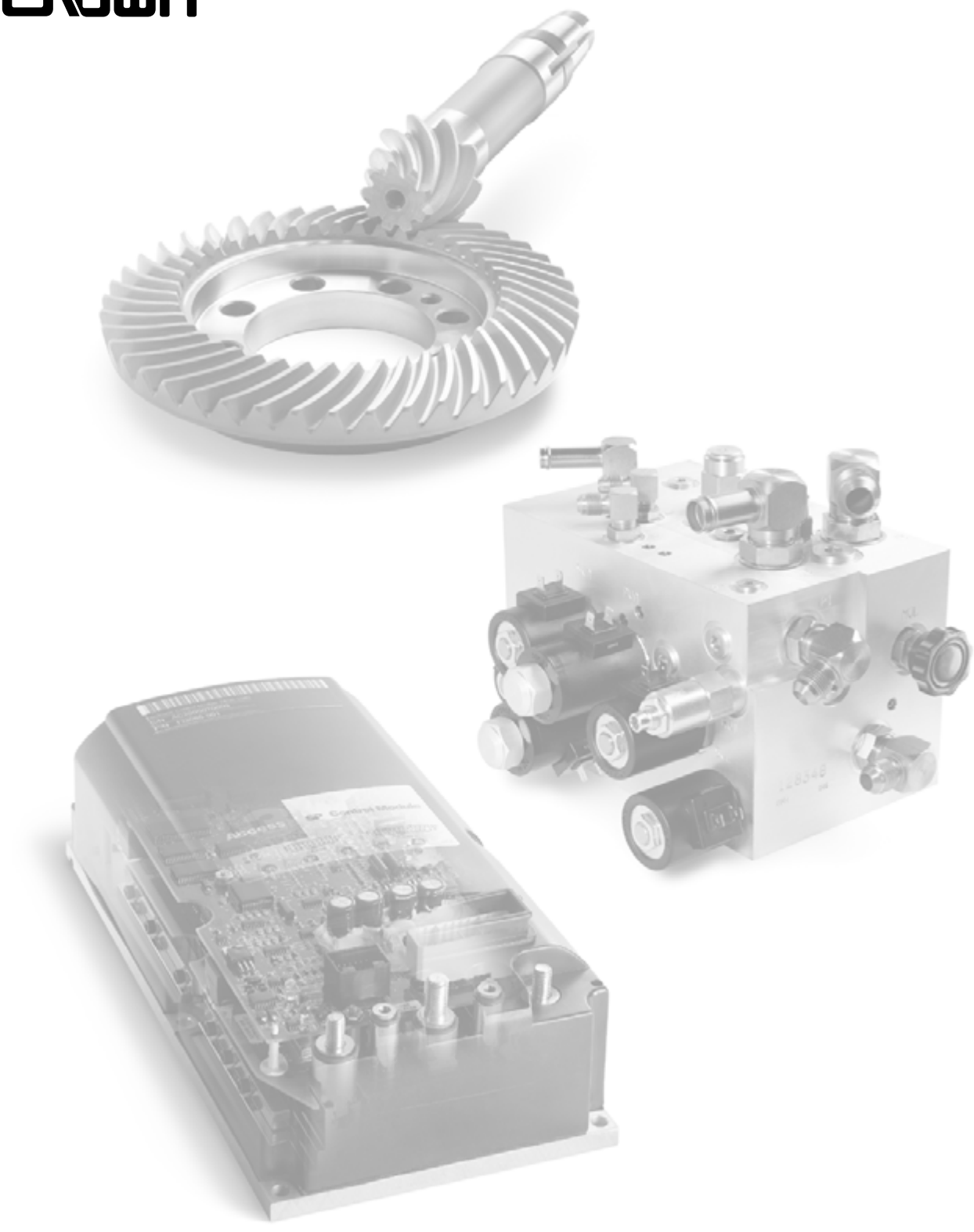
Models

This manual covers maintenance and repair work for the following model:

TC 3000-3.0



LUBRICATION & ADJUSTMENT

Notes:

Lifting and Jacking up the Truck

CAUTION

Scalding risk from battery acid!

- ***You must remove the battery before transporting the truck.***

This will prevent possible battery acid leakage in the truck and resulting material or personal damage.

Lifting the Truck

WARNING

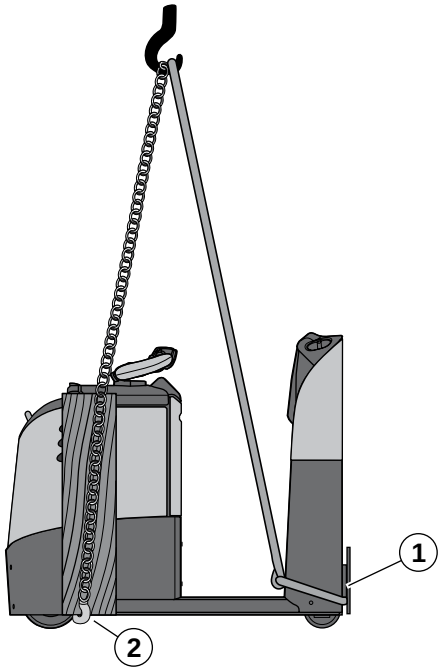
Truck tipovers and falling loads can cause death!

- *Make sure the lifting truck or crane as well as the lifting gear have sufficient capacity.*

Information on the capacity required can be found on the truck data plate under "Truck Weight Less Battery" and "Battery Weight".

Lifting the truck with a crane

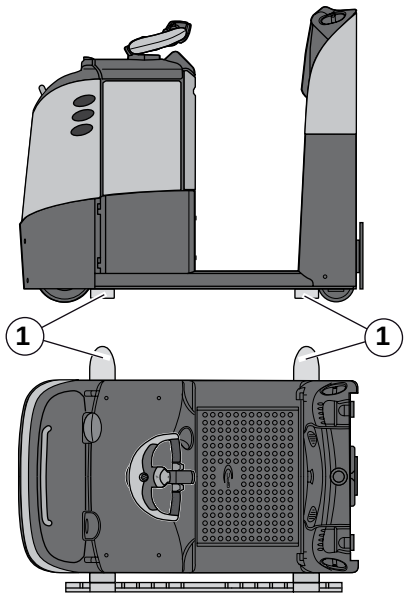
1. Remove the battery
2. Attach chains and hooks (2) to the cutouts in the floorboard in front of the battery compartment (see Fig.TC465).
3. Push a thin board on either side between the truck and the chain.
4. Attach lifting slings around the tow hitch (1) (see Fig.TC465).



TC465

Lifting the truck with a forklift truck

1. Remove the battery
2. Position the forks (1) of the truck that is doing the lifting under the chassis of the lift truck (see Fig. TC462).



TC462

3. Attach the truck securely onto the forks (1) of the truck doing the lifting (e.g. with a tensioning belt).

Jacking up the Truck

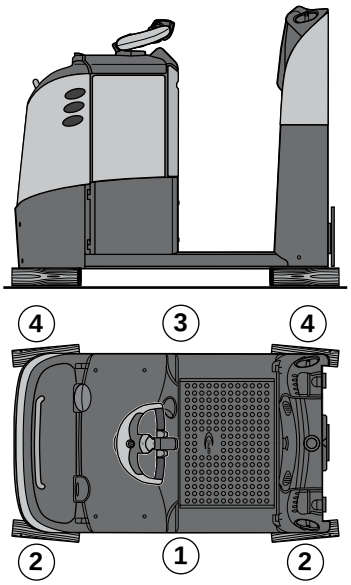
WARNING

Truck tipovers and incorrect handling of the equipment can result in fatal injuries.

- *Make sure the jack has sufficient capacity.*
- *Always support a raised truck with wooden blocks or other suitable equipment to relieve the jack.*
- *Never place your hands or other parts of your body under the truck before it has been supported.*

Information on the capacity required can be found on the truck data plate under "Truck Weight Less Battery" and "Battery Weight".

1. Place the jack in the centre of the left hand side of the skirt (1, Fig. TC463) and raise the truck a maximum of 20 mm.
2. Place hard wooden blocks (2) under the front and rear ends of the chassis and lower the truck onto them.
3. Place the jack in the centre of the right hand side of the skirt (3) and raise the truck a maximum of 20 mm.
4. Place hard wooden blocks (4) underneath and lower the truck.



TC463

Towing the Truck

WARNING

Truck tipovers and falling loads can cause death!

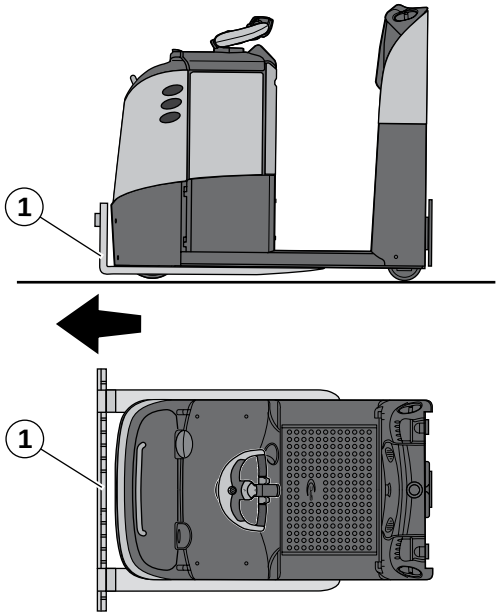
- *Make sure the towing truck has sufficient capacity.*

Information on the capacity required can be found on the truck data plate under "Truck Weight Less Battery" and "Battery Weight".

NOTE

Risk of damage to the drive system!
As the drive wheel is braked on de-energised trucks, the truck must be raised sufficiently when being towed to prevent the drive wheel from contacting the ground.

1. Remove the battery.
2. Place the forks (1) of the towing truck underneath the lift truck *(*see Fig. TC464*)*.
3. Raise the truck (approx. 20 mm) until the drive wheel has been lifted off the ground.
4. Pull the truck **slowly and only in a forward direction** *(*as indicated by the arrow in Fig. TC464*)*.



TC464

Taking the Truck out of Service

You must carry out the following tasks if you are withdrawing the truck from service for more than 3 months:

1. Disconnect the battery.
2. De-commission the battery in accordance with the manufacturer‘s instructions.
3. Clean and then lubricate the truck.

NOTE

Note the following when cleaning the truck:

- *Do not use pressure jets and/or solvents on the truck.*
- *Do not use metal brushes.*
- *Do not wet-clean the electrical system.*
- *Do not use flammable cleaning agents.*
- *Take measures to protect the environment.*

4. If possible store the truck in a dry room with as constant a temperature and air humidity as possible.
   Do not park the truck outdoors or in a humid environment.
5. If the truck has to be stored in hostile conditions (e.g. saline atmosphere) treat the surface of the truck with a suitable preservative to prevent corrosion.
6. If the truck has to be stored in excessively dusty conditions, cover it with a permeable material and not plastic sheets as these can allow condensation water to form.
7. Jack up the truck (see page 15), as otherwise the constant pressure can cause the wheels to flatten.

Testing Re-Commissioned Trucks

Trucks that have been out of service for a long period of time must be checked at regular intervals. To do this, proceed as follows:

1. Connect the battery and test the truck's functions.
2. Check the gear unit for leaks.
3. Check any anti-corrosion film that may have been added and replace if necessary.
4. Disconnect the battery.

Restoring the Truck to Service

To restore the truck to service, proceed as follows:

1. Remove the anti-corrosion film.
2. Jack up the truck, remove the wooden blocks and lower the truck.
3. Charge the battery or install a charged battery.
4. Connect the battery.
5. Carry out the daily safety inspection.

Recommended Lubricants and Accessories

The tables show typical lubricants used by Crown itself in its facilities. However, you can use any lubricants provided they meet the same technical criteria.

An anti-corrosion fluid (Crown no. 805236-004) must be applied to all screws, washers, nuts, pins, retaining rings etc. Carefully protect all electrical connections and components against corrosion. For detailed information, refer to the *Electrical System* chapter.

Service intervals (see page 19) must be adapted to the conditions of use.

Cold Store Trucks

Special hydraulic oil, lubrication oil and grease must be used for cold store trucks operating in low temperature conditions (see table).

Type	Lubricant Type	Product	Manufacturer	Crown Part Number
A	Transmission oil	Hyp 85W90	Aral	053002-004
		GX-D 85W90	Esso	
		Mobilube HD85W90	Mobil	
		Spirax MB90	Shell	
AA	Low temperature transmission oil	Mobil SHC 624	Mobil	053002-009
B	Grease (Multi-Purpose)	Aralube HLP2	Aral	053002-001
		LM Grease	Castrol	
		Regulus A2	Century	
		Beacon EP2	Esso	
		EP2	Maxol	
		Mobiluxe EP2	Mobil	
		Retinax LX	Shell	
		ALGWMI	SKF	
		Renolit MP	Fuchs	
BB	Low temperature grease	Aralube SKL2	Aral	053002-005
		Unirex Lotemp EP	Mobil	
		Duraplex EP2	Fuchs	
G	Lubrication oil	Essolube HDX+40	Esso	053002-007
		Kowal M 40	Aral	
		Delvac 1240	Mobil	
GG	Low temperature lubrication oil	Mobil SHC 626	Mobil	053002-008
M	Special grease	Molycote® BR-2 Plus	Dow Corning	----------

Lubricants	Product	Application	Crown Part No.
Anti-corrosive agent	Tectyl	Corrosion inhibitor for cold store trucks	805236-004
Rubber & Vinyl Dressing	Commercial	Rubber Components, Plastic Panels	----------

Planned Maintenance

The following inspection and maintenance schedule assumes single-shift operation under normal conditions.

The maintenance intervals must however always be adapted to the prevailing operating conditions. In dusty or otherwise extreme operating conditions including cold store application, the maintenance intervals specified must be reduced. Exact details should be discussed with a Crown service engineer.

Routinely check for wear, corrosion, damage, and test component operation and safety when carrying out maintenance work. If in doubt, replace components.

Planned maintenance must be performed either after a certain number of service hours or a certain period of time (whichever is reached first).

Guide to abbreviations:

M	Months
h	Service hours
X	Perform on standard trucks
C	Perform on cold store trucks
X/C	Perform on standard and cold store trucks

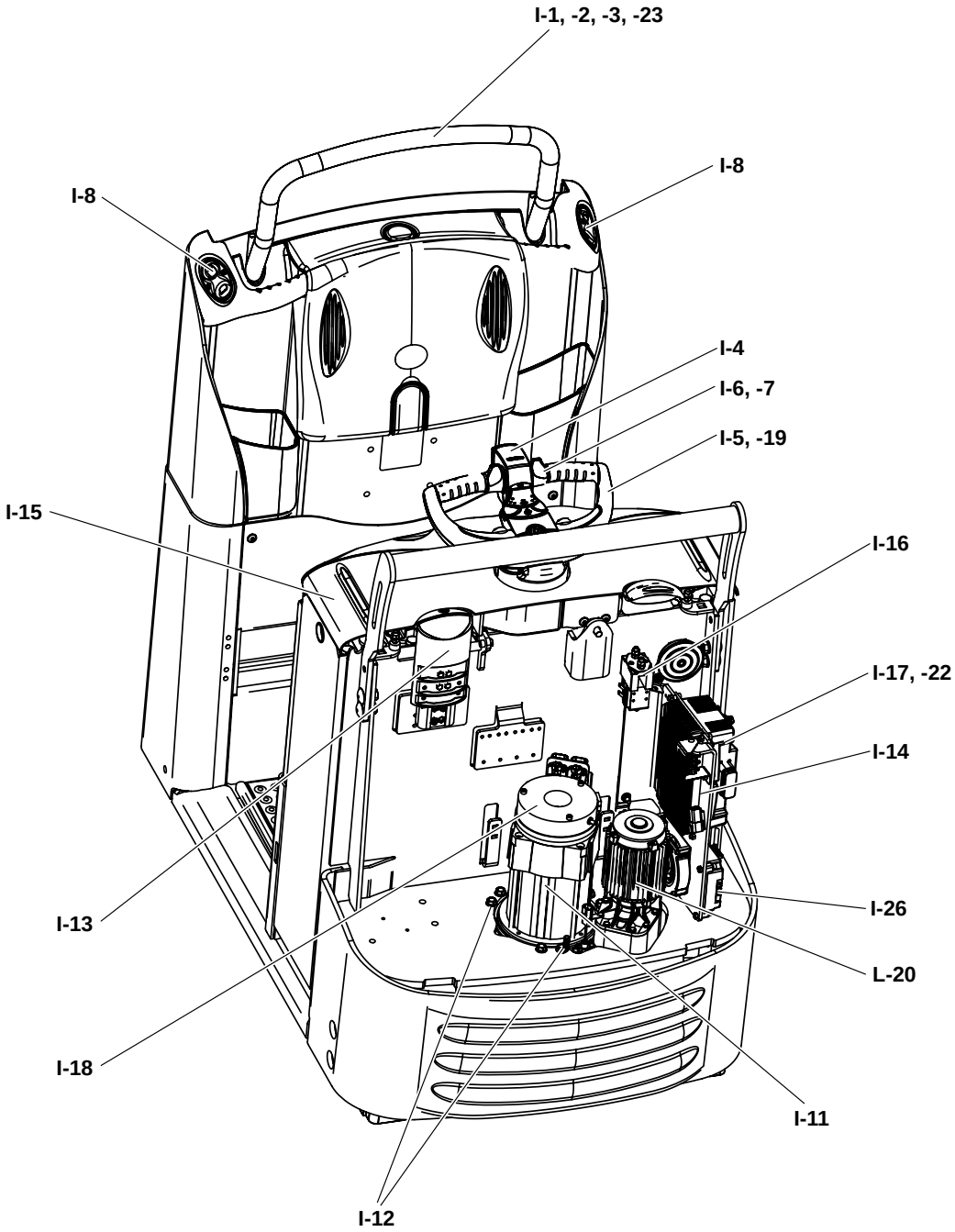
Position	Component	Lubricant	Action	12 M 500 h	24 M 1000 h	36 M 5000 h
I-1	Truck, general		Clean truck if necessary. **NOTE** *Note the following when cleaning the truck:* • *Do not use pressure jets and/or solvents on the truck.* • *Do not use metal brushes.* • *Do not wet-clean the electrical system.* • *Do not use flammable cleaning agents.* • *Note the environmental safety guidelines.*	**X/C**		
I-2	Labels, decals[a]		Check that labels and decals are legible. Replace any illegible or severely damaged decals.	**X/C**		**X**
I-3	Handles***** Backrest grab bar***** Work Assist ™*****		Ensure it is fitted securely and check for damage.	**X/C**		
I-4	Emergency Disconnect[b]		Test Emergency Disconnect power switch.	**X/C**		
I-5	Steering[b]		Check operation.	**X/C**		
I-6	Travel functions[b]		Drive the truck in both directions.	**X/C**		

Position	Component	Lubri-cant	Action	12 M 500 h	24 M 1000 h	36 M 5000 h
I-7	Brake (b)		Test by changing the travel direction with the travel switch. Check brake switch.	**X/C**		
I-8	Hitch Position Control™ (b)		Test in both directions.	**X/C**		
I-9	Load wheels and castors		Check bearing play. Check tyres for wear.	**X/C**		
I-10	Drive wheel		Check wheel nut torque (**130 Nm**). **NOTE** *On new trucks or after removing/assembling the drive wheel, torque the wheel nuts after **100 h** to **130 Nm**.* Check tyres for wear.	**X/C**		
I-11	Drive motor		Torque drive motor mounting screws to **16 Nm**.	**X/C**		
			Check that power cable connections on the drive motor are secure. Torques: Torque the bottom nut to **7.5 Nm**. Torque the top nut to **2.5 Nm**.	**X/C**		
I-12	Drive transmission unit		Torque drive transmission unit mounting screws to 70 - 75 Nm.	**X/C**		
I-13	Battery connector		Check connector housing, contact springs and cables. Clean contacts.	**X/C**		
I-14	Electrical system		Check insulation of all accessible wires for damage. Make sure switches and connections are fitted securely and check for damage.	**X/C**		
L-15	Battery cover	B/BB	Lubricate hinges and lock.	**X/C**		
I-16	Main contactor		Clean main contactor contacts and check for wear.	**X/C**		
I-17	Traction controller		Torque the traction controller mounting screws to **8 - 10 Nm**.	**X/C**		
			Check the power cable connections on the traction controller are secure. Nut torque: **13 - 15 Nm**	**X/C**		
			Check and analyse error log.	**X/C**		

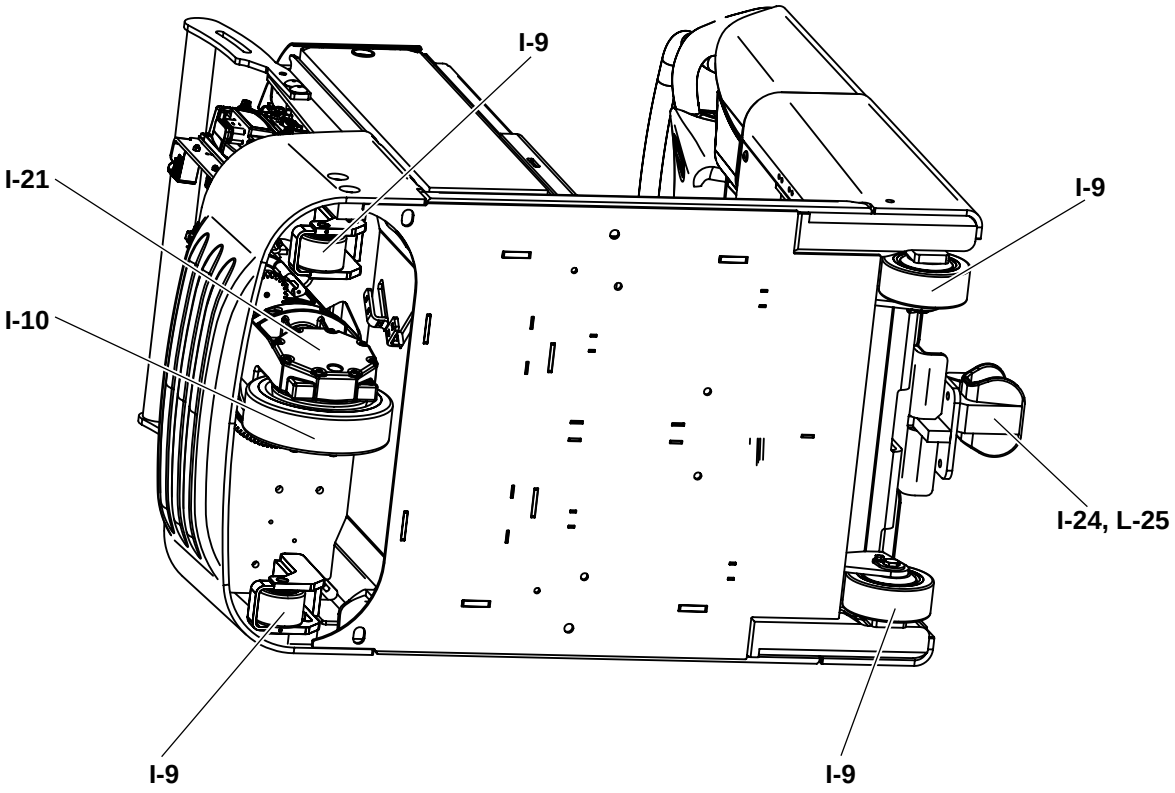
Position	Component	Lubri-cant	Action	12 M 500 h	24 M 1000 h	36 M 5000 h
I-18	Electromechanical brake		Check the dust shield ring for damage. Apply weak pressurized air to the abrasion. Measure the air gap (see page 115).		**X/C**	
I-19	Steering		Test the steering auto-reset. Replace the tiller recuperating spring if required (see page 140).	**X/C**		
I-20 L-20	Steer motor	Z/ZZ	Clean and lubricate the exposed steer motor toothing.		**X/C**	
			Check that power cable connections on the steer motor are secure. Torques: Torque the bottom nut to **3.75 Nm**. Torque the top nut to **1.25 Nm**.	**X/C**		
I-21	Drive transmission unit	K/KK	Check the oil level and replenish as required (see page 29).	**X/C**		
			Replace the oil (see page 29).			**X/C**
I-22	Traction and steering controllers		Carry out a PMT test (see page 110).	**Annually**		
I-23	Entire truck		Carry out the UVV inspection (Germany only). **In other countries:** the truck must be inspected at intervals determined by national legislation or regulations.	**Annually**		
I-24 L-25	Tow hitch and hitch plate		Test the operation of the hitch mechanism. Check that the tow hitch and hitch plate are secure. Torque the screws to standard levels and replace if damaged. Lubricate the tow hitch including the drawbar eye and drawbar eye support.	**X/C**		
I-26	Steering controller		Torque the steering controller mounting screws to **8 - 10 Nm**.	**X/C**		
			Check the power cable connections on the steering controller are secure. Nut torque: **2.5 - 3 Nm**	**X/C**		

a. For items numbers and ordering information refer to the spare parts catalog.
b. See operator manual.

Inspection and Lubrication Points



TC412



TC413

Torques

Standard Torques

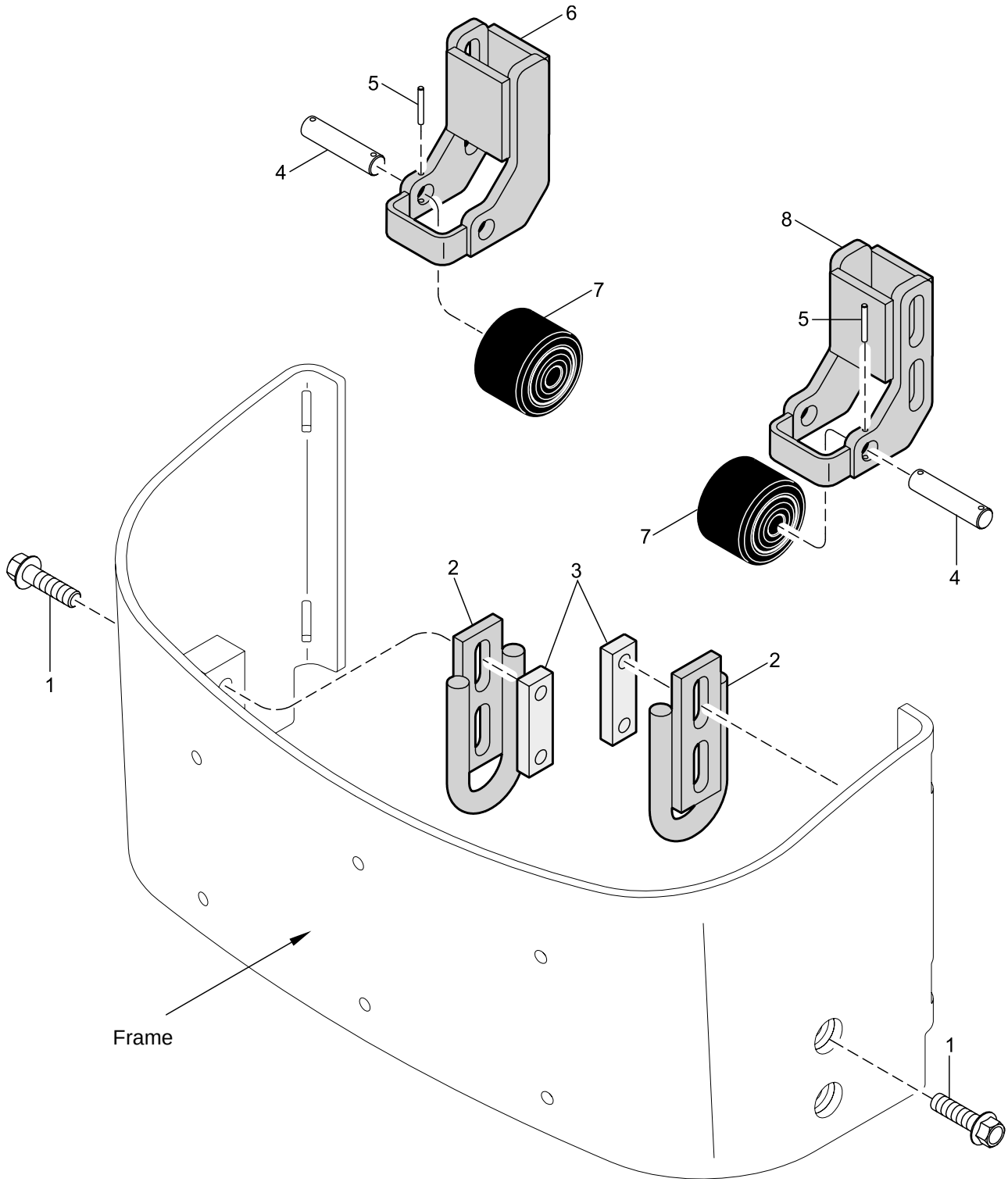
NOTE

The torques listed in the manual always take precedence over standard torques.

Standard Screws and Nuts			
Grade:	**8 and 8.87**	**10 and 10.9**	**12 and 12.9**
Thread Size	**Torque (Nm)**		
M5 x 0.8	5 - 6	7 - 8	8 - 10
M6 x 1	8 - 10	12 - 14	14 - 16
M8 x 1.25	20 - 25	30 - 35	34 - 40
M10 x 1.5	40 - 45	60 - 65	70 - 75
M12 x 1.75	70 - 80	100 - 110	115 - 130
M16 x 2	170 - 190	240 - 270	280 - 320
M20 x 2.5	340 - 380	450 - 500	550 - 600
M24 x 3	580 - 650	800 - 900	900 - 1050
M30 x 3.5	1150 - 1300	1600 - 1800	1850 - 2100

Umbrako screws and nuts		
Grade	**10 and 10.9**	**12 and 12.9**
Thread Size	**Torque (Nm)**	
M5 x 0.8	8	11
M6 x 1	14	19
M8 x 1.25	33	45
M10 x 1.5	63	86
M12 x 1.75	111	152
M16 x 2	270	372
M20 x 2.5	521	717

Castor Wheels and Skids



TC003

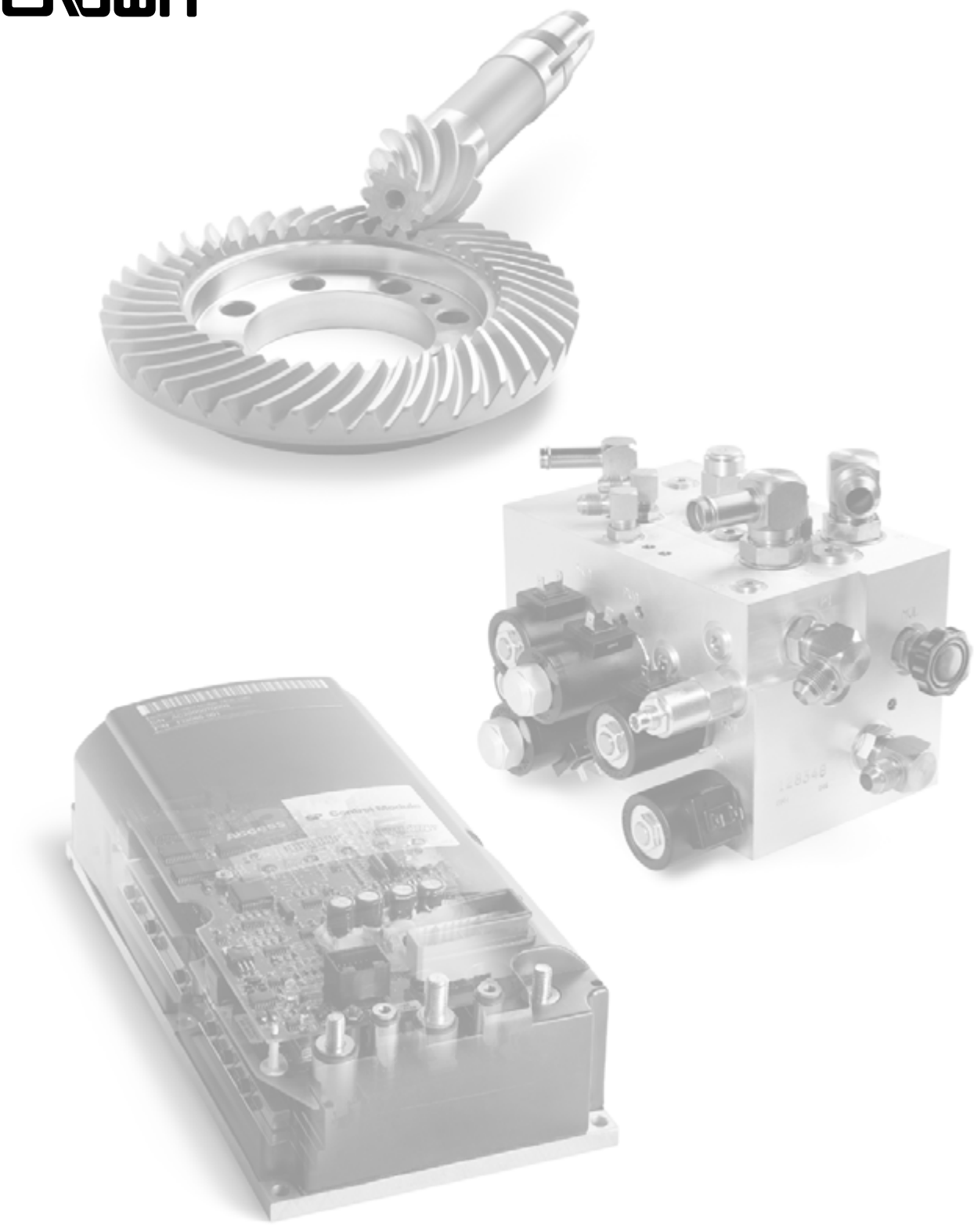
Adjusting the Castor Wheels and Skids

The castor wheels (7) and skids (2) must be 5 mm above the ground to prevent the truck from tipping over around corners. The castor wheels and skids are adjusted in the same way.

1. Position the unladen truck on a level surface.
2. Switch the truck off and prevent it from being switched on again.
3. Check the condition of the castor wheels (7) / skids (2) and make sure they are 5 mm above the ground.

Note: Any worn castor wheels or skids must be replaced. If the distance from the castor wheels / skids to the ground is more than 5 mm, they must be re-adjusted.

4. Place a 5 mm thick plate under the castor wheels (7) or skids (2).
5. Loosen the screws (1) on either side and move the castor wheels (7) or skids (2) over the slotted holes so that they are positioned on the plate.
6. Torque the screws (1) on either side to standard levels and remove the plate.
7. Switch on the truck and carry out a test run.



DRIVE UNIT

Notes:

Changing the Transmission Oil

CAUTION

Hazardous chemicals can cause serious injury. Observe the manufacturer's safety instructions when handling solvents and lubricants.

Allow the transmission oil to reach operating temperature before changing it. This ensures that it can drain off quickly and take any contamination with it.

For oil change intervals see *"Routine Maintenance"*, page 19.

For authorised oil grades see *Recommended Lubricants and Accessories*, page 17. The approximate capacity is 1.8 litres.

NOTE

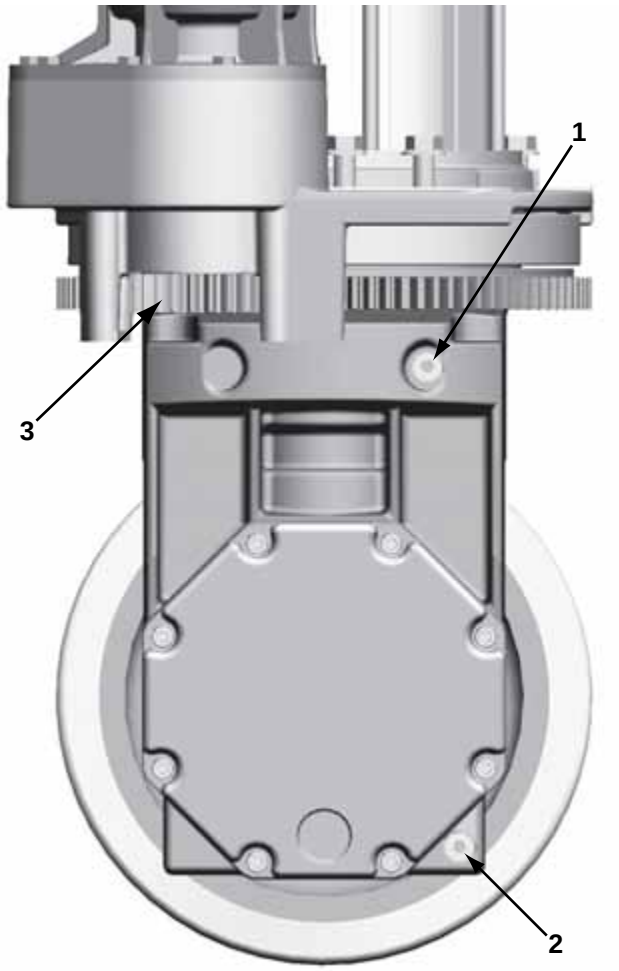
The refill plug can only be accessed when the truck is raised. Therefore a crane or another truck with sufficient capacity must be used to raise the truck. Jacking up the truck is prohibited for safety reasons. Alternatively, if the truck can only be raised by a certain amount, the drive motor can be removed (see page 103) in order to add oil via the open gear unit cover.

WARNING

Danger of death
A falling truck can kill you!
Always use lifting gear, slings and blocks with sufficient capacity.
Carry out the following tasks before standing underneath a raised truck:

- *Support the truck raised with a crane in such a way that it cannot fall down even if the lifting gear cracks or the crane fails.*
- *If the truck is raised with a forklift truck, it must be secured on the forks of the truck doing the lifting, to prevent it from slipping and falling off.*
- *Physically block the lift mechanism of the truck doing the lifting before you stand underneath the raised load.*

1. Raise the truck with a crane or forklift truck (see pages 13 and 14) until the drive wheel is clear of the ground.
2. Secure the raised truck to prevent it from lowering accidentally.
3. Power up the truck and apply the steering to turn the drive wheel so that the refill plug (1) and the drain plug (2) are accessible.
4. Switch off the truck and prevent it from being switched on again.
5. Place a flat tray with a minimum capacity of 2 litres underneath to collect the used oil.



GPC411

1 Refill plug
2 Drain plug
3 Steering toothing

For gear units with a refill plug:

– Unscrew the refill plug (1, see Fig. GPC411).

For gear units without a refill plug:

– Remove the drive motor (see page 103).

6. Unscrew the drain plug (2, see Fig. GPC411) and collect the oil.
7. Dispose of used oil in accordance with environmental and local regulations.
8. Clean the drain plug (2), screw it on and tighten.

NOTE

Make sure to use the correct oil grade: cold store trucks require a different type of oil than standard trucks.

9. Add a suitable transmission oil (see *Recommended Lubricants and Accessories* on page 17).
   – Capacity: approx. 1.8 litres
10. Clean the refill plug (1), screw it on and tighten.
11. Remove the jack from the truck and the device to prevent it from being switched on.
12. Test the steering.
13. Lubricate steering toothing (3, see Fig. GPC411) with type M lubricant (see *Recommended Lubricants and Accessories* on page 17).

Components

The drive unit consists of a drive assembly and a steering assembly.

The drive assembly comprises the following:

- Brake (1)
- Drive transmission unit (4)
- Drive wheel (5)
- Drive motor (6)

The steering assembly comprises the following:

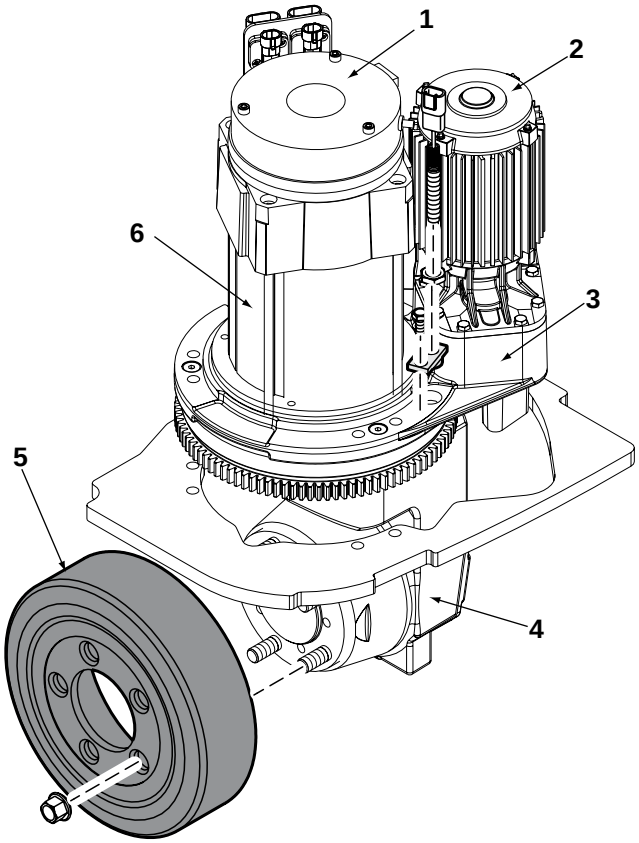
- Steer motor (2)
- Steering transmission (3)

If the drive unit is to remain in the truck, the following components can be removed and installed again:

- Brake (see page 115)
- Drive motor (see page 103)
- Steering assembly (see page 105)
- Drive wheel (see page 35)
- Shaft seal of the output shaft on which the drive wheel (5) is seated (see page 32).

NOTE

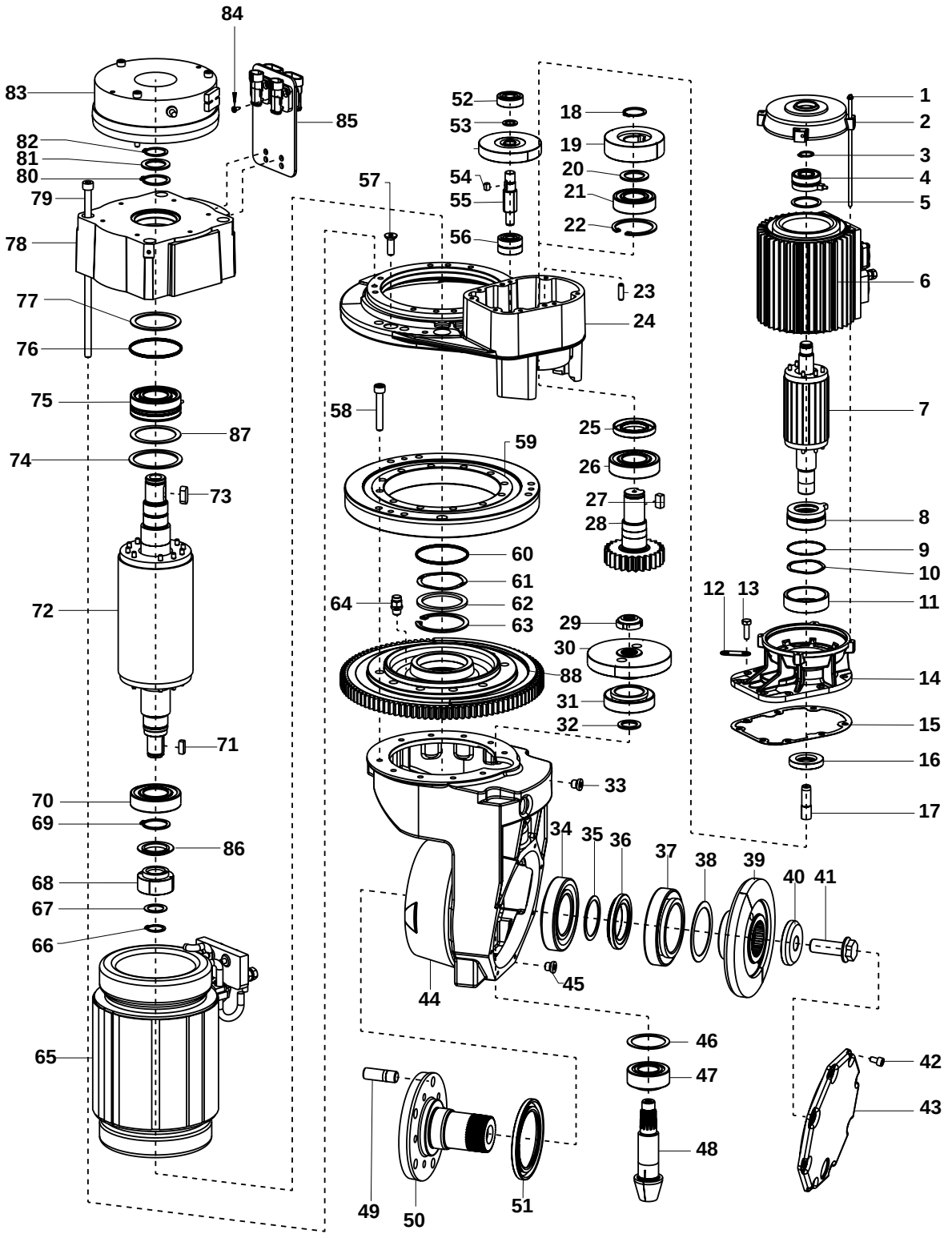
In the following sections we will first describe operations that can be performed on the drive transmission unit with the drive unit installed. This will be followed by the removal and complete disassembly of the drive transmission unit.



GPC418

1 Brake
2 Steer motor
3 Steering transmission
4 Drive transmission unit
5 Drive wheel
6 Drive motor

Replacing the Output Shaft Seal



GPC412

Special Tools Required

Tool to press in the shaft seal (part no. 822671).

Preparation

1. Jack up the truck and secure it (see page 13).
2. Drain the transmission oil (see page 29).
3. Disassemble the drive wheel (see page 35).

Shaft Seal Removal

The item numbers refer to Figure GPC412 on page32.

Output shaft removal

1. Remove the screws (42) and take off the cover (43).

Note: If there is a cover pressed in on the gear unit, it must be damaged in order to remove it. Proceed as follows:

1. Carefully penetrate the cover with a large screwdriver and a hammer.
2. Lever off the cover with the screwdriver.

The cover (43) is now removed. Proceed as follows:

1. Loosen the screw (41) and remove it together with the washer (40).
2. Press off the output shaft (50).
3. Remove the shims (35) and bushing (36).
4. Pull off the bearing (34) and remove the shaft seal (51) from the output shaft.

Output shaft assembly

CAUTION

Hazardous chemicals can cause serious injury. Observe the manufacturer's safety instructions when handling solvents and lubricants.

1. Grease the sealing lip of the new shaft seal.
2. Place the shaft seal (51) onto the output shaft (50).
3. Press on a new bearing (34).
4. Fit the shims (35) and bushing (36).
5. Push the pre-assembled output shaft (50) into the gear unit.
6. Assemble the washer (40) and screw (41).
7. Torque the screw (41) to **260 Nm**.

Note: Check the output shaft friction torque after each assembly.

- It should be 4 - 10 Nm

If the friction torque is out of range, proceed as follows:

Adjusting the output shaft friction torque

1. Remove the output shaft again.

- To reduce the friction torque:
  - Increase the rated size of the shims (35).
- To increase the friction torque:
  - Reduce the rated size of the shims (35).

2. Reassemble the output shaft.

Check the friction torque again and re-adjust if required.

3. Using the special tool press the shaft seal (51) over the holes in the output shaft flange into its correct position.

To assemble the cover (43) with screws:

1. Clean the contact surfaces of the housing (44) and cover (43) with a suitable solvent.
2. Apply a sealing compound to the contact surfaces in accordance with the manufacturer's instructions. We recommend either Loctite® 518, Loctite® 574 or Terostat® MS935.
3. Place the cover (43) in position and torque the screws (42) to **10 Nm**.

NOTE

Check the hardening time of the sealing compound used before adding oil.

4. Add transmission oil (see *page 29*).

To press on the cover (43):

NOTE

The cover may get damaged during assembly. To fit the cover use a secure washer to place the cover on.

1. Fit a new cover (43) with the sealed side facing out.
2. Using a plastic hammer and a secure washer (∅ 148 - 150 mm) underneath, strike the cover evenly without damaging it.
3. Insert and tighten the drain plug (45).

NOTE

Check the hardening time of the sealing compound used before adding oil.

4. Add transmission oil (see *page 29*).

Drive Wheel and Wheel Bolt Replacement

Drive Wheel Disassembly

The truck must be raised in order to remove the drive wheel (see page 13).

WARNING

Danger of death
A falling truck can kill you!
Always use lifting gear, slings and blocks with sufficient capacity to raise the truck.
Carry out the following tasks before standing underneath a raised truck:

- *Support the truck raised with a crane in such a way that it cannot fall down even if the lifting gear cracks or the crane fails.*
- *If you are raising the truck with another forklift truck, secure it to the forks of the truck doing the lifting so that it cannot slip or fall down.*
- *Physically block the lift mechanism of the truck doing the lifting before you stand underneath the raised load.*

1. Raise the truck with a crane or forklift truck (see page 13) until the drive wheel is clear of the ground.
2. Secure it against accidental lowering.
3. Switch on the truck and turn the steering until the drive wheel nuts can be accessed.
4. Power down the truck.
5. Disconnect the battery and prevent the truck from being switched on again.
6. Unscrew the wheel nuts and remove the drive wheel.

Replacing the Wheel Bolts

If the wheel bolts are damaged, proceed as follows:

1. Remove the wheel bolts with a bolt extractor.
2. Fit new wheel bolts (49, Fig. GPC412, page 32) with Loctite® 243™.

Drive Wheel Assembly

Assembly of the drive wheel is the reverse of disassembly. Torque the wheel nuts crosswise to **130 Nm**.

Replacing the Drive Unit

The truck must be raised in order to replace the drive unit.

WARNING

Danger of death
A falling truck can kill you!
Always use lifting gear, slings and blocks with sufficient capacity to raise the truck.
Carry out the following tasks before working underneath a raised truck:

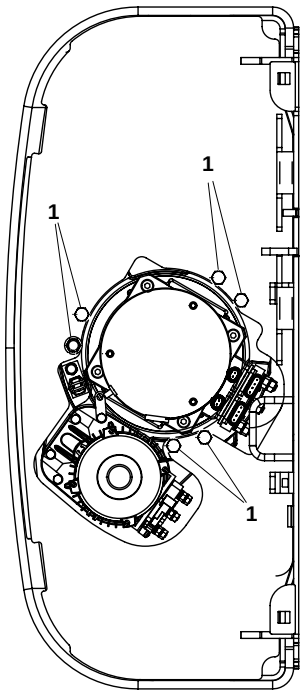
- *Support the truck raised with a crane in such a way that it cannot fall down even if the lifting gear cracks or the crane fails.*
- *If you are raising the truck with another forklift truck, secure it to the forks of the truck doing the lifting so that it cannot slip or fall down.*
- *Physically block the lift mechanism of the truck doing the lifting before you stand underneath the raised load.*

Special Tools Required

A home-made device for holding the drive unit.

Drive Unit Removal

1. Disconnect the battery and prevent the truck from being switched on again.
2. Disconnect all electrical connections to the drive motor, brakes, steer sensor and steer motor.
3. Raise the truck either with another forklift truck or with a crane (see page 13) so that the device for holding the drive unit can be pushed underneath the truck.
4. Drain the oil (see page 29).
5. Push the device for holding the drive unit underneath the truck.
6. Remove the mounting screws (1, Fig. TC415).
7. Raise the truck until the drive unit is free.
8. Pull out the drive unit or move the raised truck.



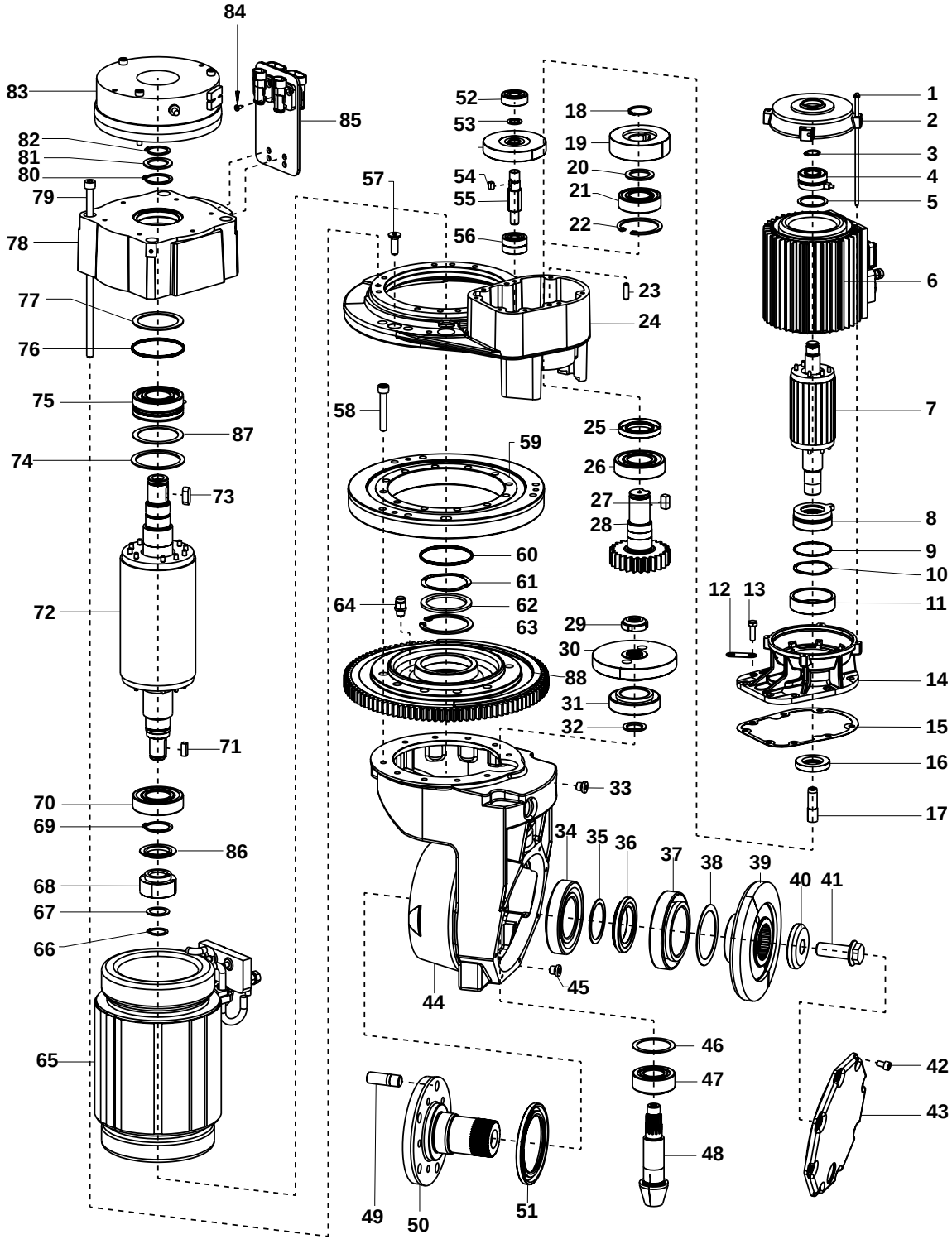
TC415

1 Mounting screw

Drive Unit Installation

1. When assembling a new gear unit, remove the steer sensor from the old gear unit and attach it to the new one (see page 141).
2. Assemble the drive unit in the reverse order of disassembly.
3. Torque the mounting screws (1, Fig. TC415) to **70 - 75 Nm**.
4. Add transmission oil (see page 29).

Repairing the Drive Transmission Unit



GPC412

NOTE

Gear unit repair work requires specialist expertise and experience, as well as special tools. Note that all the bearings and seals must be replaced.
If you cannot meet these particular requirements, use a new drive transmission unit.

Preparation

The item numbers refer to Figure GPC412 on page 37.

1. Remove the drive unit (see page 36).
2. Remove the drive motor (see page 103).
3. Remove screws (57).
4. Lift off the entire steering assembly.
5. Remove screws (58).
6. Extract the live ring bearing (59).
7. Remove the bleeder valve (64).
8. Remove the O-ring (60), shim (61), supporting ring (62) and retaining ring (63).
9. Remove the gear unit cover (88).

Drive Transmission Unit Disassembly

Output shaft removal

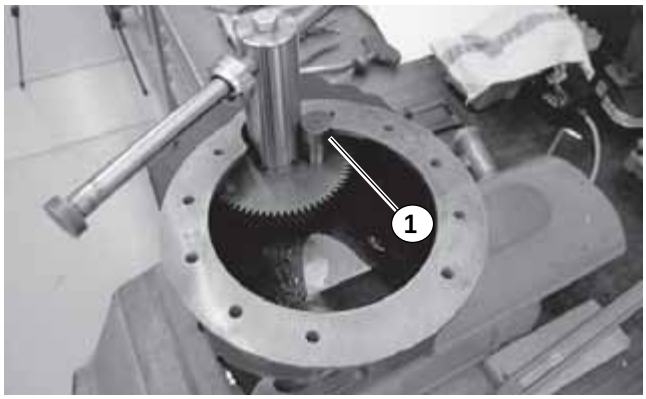
1. Remove the screws (42) and take off the cover (43).

Note: If there is a cover pressed in on the gear unit, it will necessarily be damaged if removed. To do this, proceed as follows:

1. Penetrate the cover (43) with a large screwdriver and a hammer.
2. Lever off the cover (43) with the screwdriver.

The cover (43) is now removed. Proceed as follows:

1. Prevent the gear unit from twisting: insert the mandrel (1) see Fig. GPC415_1 in the hole of the pinion (30).



GPC415_1

1 Mandrel

2. Loosen the screw (42) and remove it together with the washer (41).
3. Press off the output shaft (50).
4. Remove the shims (35) and bushing (36).
5. Pull off the bearing (34) and remove the shaft seal (51) from the output shaft.

Bevel gear and bevel pinion removal

GPC416_1

39 Bevel gear

1. Remove the bevel gear (39, see Fig. GPC416_1) together with the bearing (37) and washer (38) from the housing (44).
2. Push the bearing (37) through the two holes of the bevel gear (39) and remove the washers (38).
3. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
4. Remove the groove nut (29).
5. Pull the bevel pinion shaft (48) and conical roller bearing (47) and washers (32) out from underneath the gear unit.
6. Remove the washers (32).
7. Remove the conical roller bearing (47) from the bevel pinion shaft (48).
8. Remove the pinion (30) and the conical roller bearing (31) from the housing (44).
9. Pull the conical roller bearing (31) off the pinion (30).
10. Take the outer rings of the conical roller bearings (31, 47, 37, and 34) off the housing (44).
11. Remove the washer (46) from the housing (44).

Drive Transmission Unit Assembly

NOTE

Always use new bearings and seals to assemble the drive transmission unit.

Bevel pinion and drive pinion assembly

1. Insert the washer (46) into the housing (44).
2. Use a press to force the outer rings of the conical roller bearings (31, 47, 37, 34) into the housing (44).
3. Press the conical roller bearing (47) onto the bevel pinion shaft (48).
4. Fit the support ring with a shim (32).

Note: The combined nominal size of both shims is 2.2 mm.

5. Press the conical roller bearing (31) onto the pinion (30).
6. Insert the pinion (30) in the correct position into the housing (44).
7. Insert the bevel pinion shaft (48) into the pinion (30).

The bevel pinion shaft (48) and the pinion (30) must now be installed into the gear unit:

8. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
9. Screw the groove nut (29) onto the bevel pinion shaft (48) and torque to **35 Nm**.
10. Remove the mandrel (1).

Note: Check the bevel pinion shaft (48) friction torque after each assembly.

- It should be 0.1 - 0.2 Nm

If the friction torque is not within range, proceed as follows:

Adjusting the bevel pinion shaft friction torque

1. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
2. Remove the groove nut (29).
3. Pull the bevel pinion shaft (48) and conical roller bearing (47), supporting ring and shim (32) out from underneath the gear unit.

- To reduce the friction torque:
  - Add a shim.
- To increase the friction torque:
  - Remove a shim.

4. Insert the bevel pinion shaft (48) back into the pinion (30).
5. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
6. Screw the groove nut (29) onto the bevel pinion shaft and torque to **35 Nm**.
7. Remove the mandrel (1).
8. Check the bevel pinion shaft friction torque again and re-adjust if required.

Bevel gear assembly

GPC416_1

39 Bevel gear

1. Place the shim (38) onto the bevel gear (39).

Note: The nominal size of the shim is 1.0 mm.

2. Press the conical roller bearing (37) onto the bevel gear (39).
3. Insert the bevel gear (39) in the correct position into the housing (44).
4. Assemble and install the output shaft and adjust the friction torque (see *Output shaft assembly*, *page 33*).

GPC417_1

30 Pinion

5. Check the bevel gear toothing on the reference diameter of the pinon (30) (see Fig. GPC417_1):

Note: The maximum bevel gear toothing clearance is 0.2 - 0.5 mm.

If there is any deviation, the bevel gear toothing clearance must be adjusted.

Adjusting the bevel gear toothing clearance

1. Loosen the screw (42) and remove it together with the washer (41).
2. Press off the output shaft (50).
3. Remove the bevel gear (39), conical roller bearing (37) and washer (38) from the housing (44).
4. Push the bearing (37) through the two holes of the bevel gear (39).
5. Remove the washers (38) and adjust the thickness:
   - To reduce the clearance: Increase the number of shims (38).
   - To increase the clearance: Reduce the number of shims (39).
6. Fit the washers (38) with the adjusted size.

7. Press on the conical roller bearing (37).
8. Fit the pre-assembled bevel gear in the correct position in the housing.
9. Re-fit the output shaft and check the clearance again.

Carry out adjustments as required, until the clearance is between 0.2 - 0.5 mm.

10. Using the special tool (part no. 822671) press the shaft seal (51) over the holes in the output shaft flange as far as the stop of the special tool.

To assemble the cover (43) with screws:

CAUTION

Hazardous chemicals can cause serious injury. Observe the manufacturer's safety instructions when handling solvents and lubricants.

1. Clean the contact surfaces of the housing (44) and cover (43) with a suitable solvent.
2. Apply a sealing compound to the contact surfaces in accordance with the manufacturer's instructions. We recommend either Loctite® 518, Loctite® 574 or Terostat® MS935.
3. Attach the cover (43) with the screws (42). Torque the screws (43) to **10 Nm**.

NOTE

Check the hardening time of the sealing compound used before adding oil.

To press on the cover (43):

1. Fit a new cover (43) with the sealed side facing out.

NOTE

The cover may get damaged during assembly. To fit the cover use a secure washer to place the cover on.

2. Using a plastic hammer and a secure washer (∅ 148 - 150 mm) underneath, strike the cover evenly without damaging it.

The cover (43) is now installed. To finish assembling the bevel gear proceed as follows:

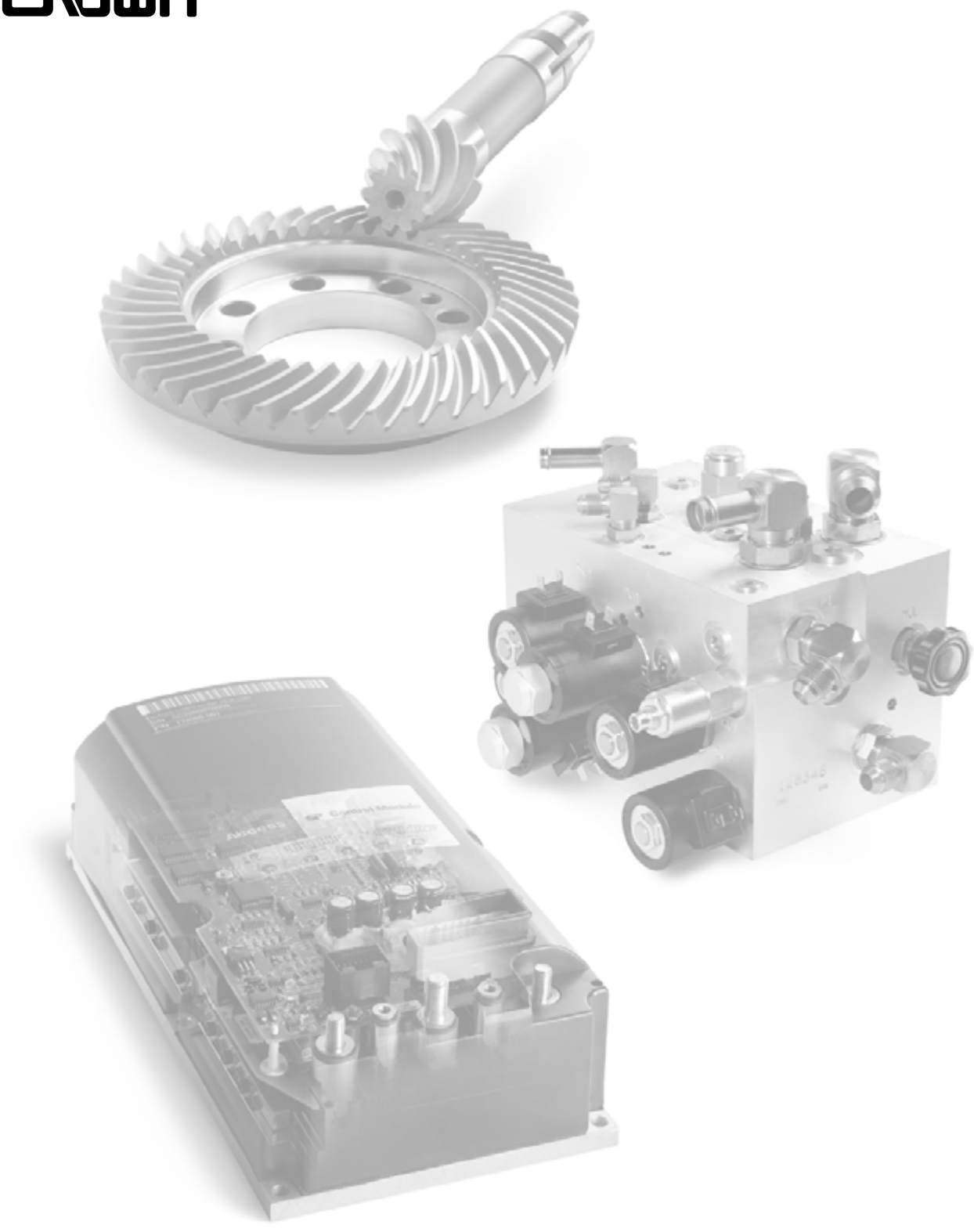
1. Fit the cover (31) in the correct position.
2. Fit the live ring bearing (59) in the correct position and fasten with the screws (58). Torque the screws to 25 Nm.
3. Install the bleeder valve (64).
4. Insert and tighten the drain plug (45).
5. Remove the O-ring (60), shim (61), supporting ring (62) and retaining ring (63).
6. Attach the steering gear together with the steer motor and intermediate flange (24).

NOTE

Check the hardening time of the sealing compound used before adding oil.

7. Add oil (see page 29).
8. Assemble the drive motor (see page 103).
9. Assemble the drive unit (see page 36).

Notes:



ELECTRICAL SYSTEM

Notes:

General

Wire Colour Code

The wires used in the truck are colour-coded and numbered according to their function. The first digit or the first two digits refer to the wire colour while the last two digits are counters.

Third party component wires may pose an exception to this rule:

Abbreviation	Colour	Colour number	Function
BLK	Black	0 **	Digital signal
BRN	Brown	1 **	Analog signal
RED	Red	2 **	Positive not connected
ORG	Orange	3 **	+12 VDC - transformer
YEL	Yellow	4 **	Third DC - transformer
GRN	Green	5 **	Negative not connected
BLU	Blue	6 **	Negative, insulated
VIO	Violet	7 **	+5 VDC - transformer
GREY	Gray	8 **	Fourth DC - transformer
WHT	White	9 **	Various
RED/WHT	Red/White	29 **	Positive connected
GRN/WHT	Green/White	59 **	Negative connected
** Numbers 01 to 99			

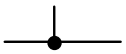
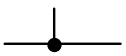
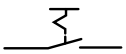
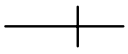
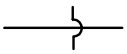
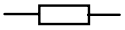
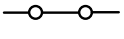
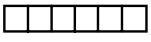
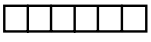
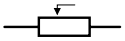
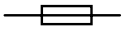
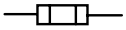
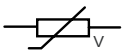
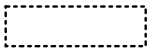
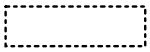
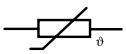
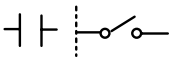
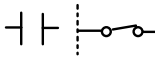
Contact Symbol Abbreviations

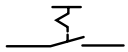
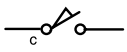
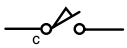
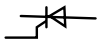
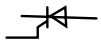
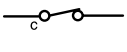
Abbrevia-tion	Description	Abbreviation	Description (Sheet 1 of 2)
K*	Relays	LMS	Limit switch
ACS	Travel switch	LOS	Lower Switch
AXS	Auxiliary function switch	ORS	Override switch
BRS	Brake switch	POT	Potentiometers
DIS	Travel direction switch	RA	Raise potentiometer
DRS	Door switch	RAS	Raise switch
EDS	Emergency power disconnect	REA	Reach potentiometer
EM	Encoder module	RS	Reverse switch
ENC	Encoders	SAS	Safety reverse switch
FS	Forward switch	SDS	Start switch
HBS	Handbrake switch	SES	Seat switch
HNS	Horn switch	SSS	Sideshifter switch
HSS	Rabbit/Turtle toggle switch	THS	Thermo switch
KYS	Key switch	TLT	Tilt switch
LGS	Light switch	WAS	Walk-along / pedestrian mode switch
BV (AK)	Battery voltage after the key switch	M2 (PM)	Pump motor
BDI	Battery discharge indicator	MRC	Control module
BR	Brake	OHGD	Overhead guard display
BWI	Brush wear indicator	P	Pump contactor
CA	Cable connection	PC	Plug connection
F	Field coil connection	PCB	Printed circuit board
FAN	Fan	SF	Shunt field
FU	Fuse	STI	Steering wheel indicator
HN	Horn	SV	Solenoid valve
IFD	Information display	TB	Terminal block
JC	Socket = counterpart to PC	TMM	Truck management module
LINE	Main contactor	TT	Hourmeter
M1 (TM)	Traction Motor	VMN	Motor driver (volt motor negative)
GPCSR	Safety switch - RH side restraint	GCSL	Safety switch - LH side restraint
PLS	Platform switch	TCM	Traction Motor
PS	Pressure switch	HR	Heating
HCM	Hydraulic control module	ALM	Travel alarm

Abbrevia-tion	Description	Abbreviation	Description (Sheet 2 of 2)
RECEIVER	Receiver	TRANSMITTER	Transmitter
BDI	Combination instrument	CHARGER	On-board charger
BRK	Electromagnetic brake	DR	Driver
SLS	Sideshift left switch	SRS	Sideshift right switch
ECS	Lift control switch	---	---

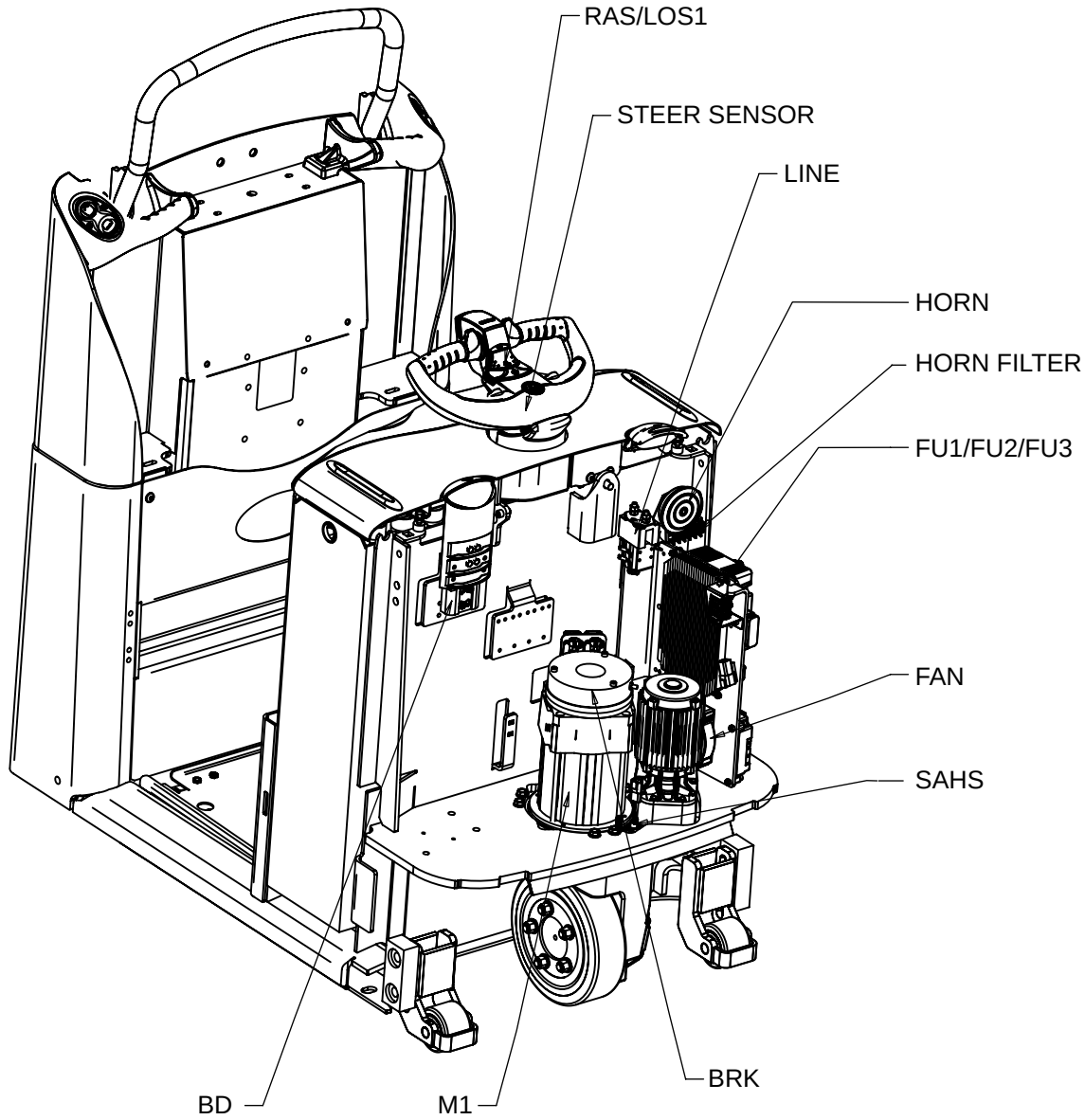
* If one of the above abbreviations is used more than once, a number extension will be used, e.g. SV1, SV2 etc.

Electrical Wiring Diagrams

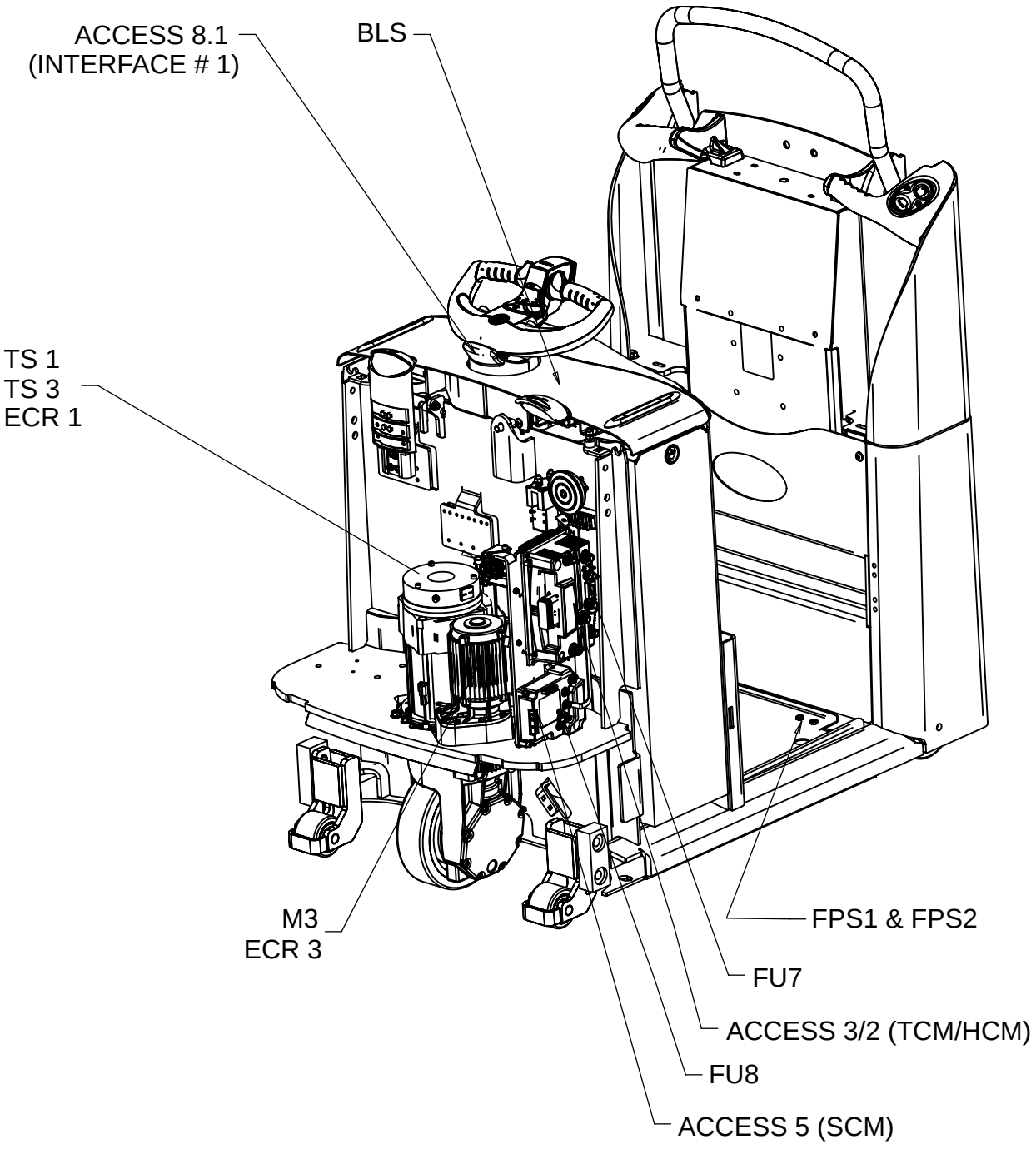
Europe	USA	Description	Europe	USA	Description
		Wires joining			Switch applied manually
		Wires crossing			Solenoid valve
		Wire connection			Throttle / coil
		Plug / socket			Resistor
		Wire strap			Capacitor
		Terminal board			Potentiometer
		Fuse			Varistor
		Assembly			Thermal protector
		Contact, normally open			Lamp
		Contact, normally closed			Horn
		Selective switch			Battery
		Contactors/Relays			Diode
		Slow release contactor / relay			Breakdown diode
		Time delay contactor / relay			LED
		Switch, normally open			Transistor

Europe	USA	Description	Europe	USA	Description
		Push button, mechanically actuated			MOSFET
		Pushbutton, hydraulically actuated			Thyristor
		Emergency power disconnect			Comparator
		Motor armature	---		

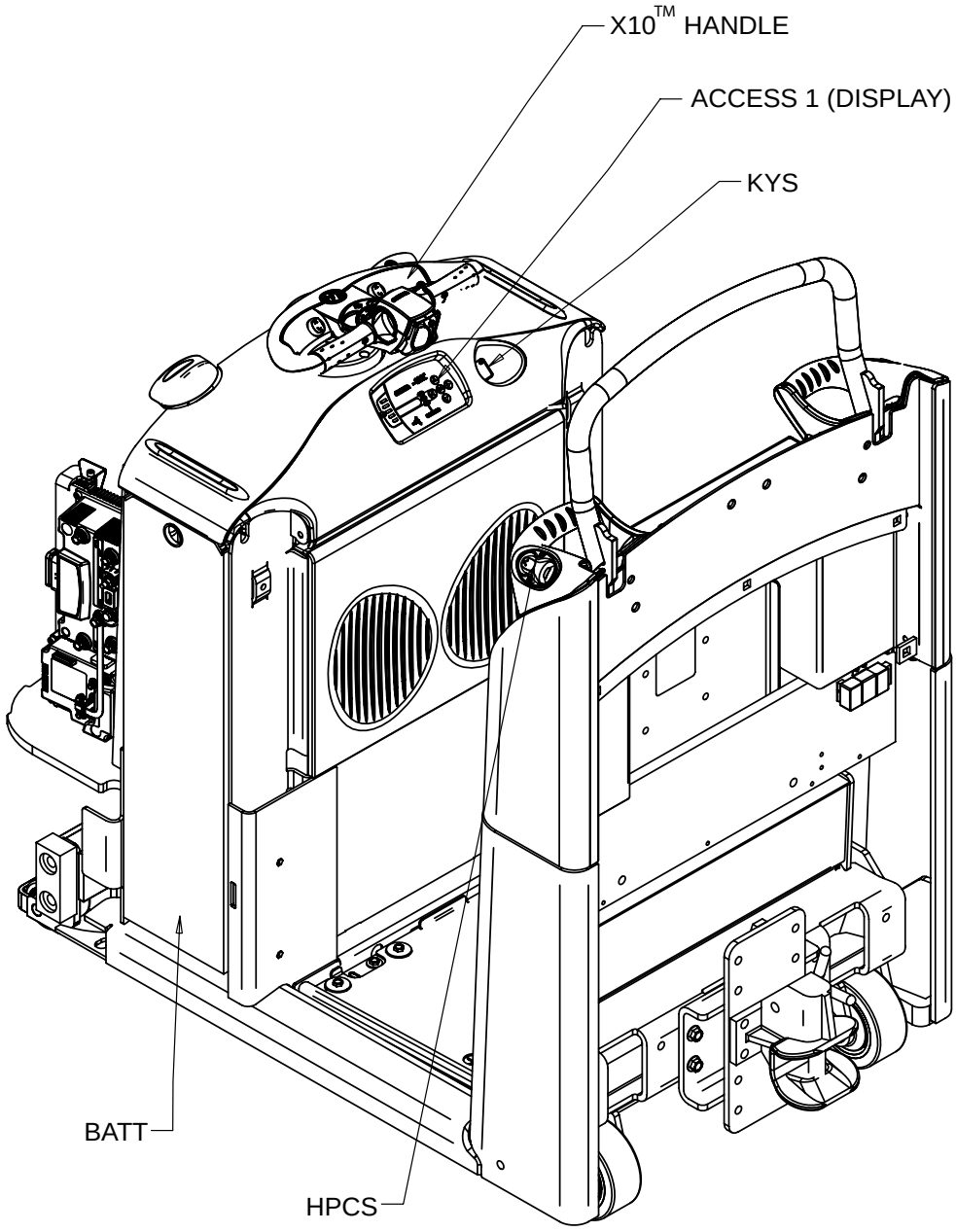
Components



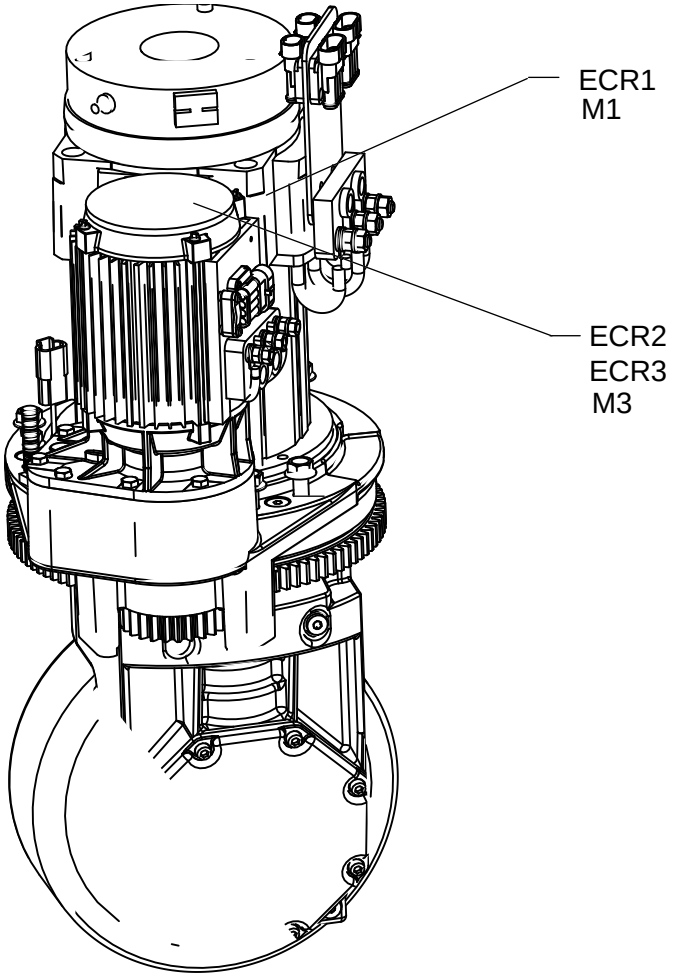
TC408


ACCESS 8.1
(INTERFACE # 1)
BLS
TS 1
TS 3
ECR 1
M3
ECR 3
FPS1 & FPS2
FU7
ACCESS 3/2 (TCM/HCM)
FU8
ACCESS 5 (SCM)

TC409

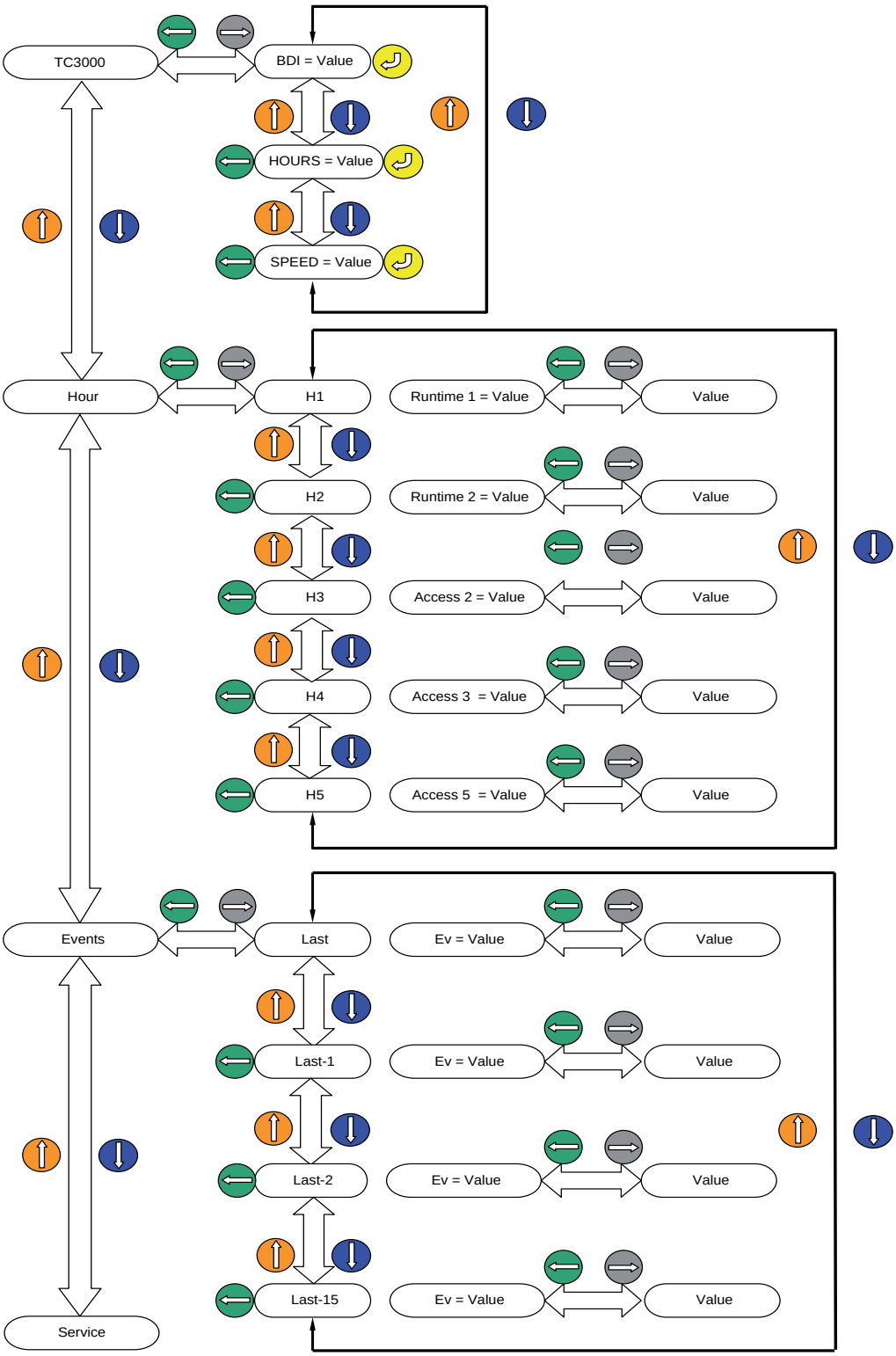


TC410



TC411

Operator Menu

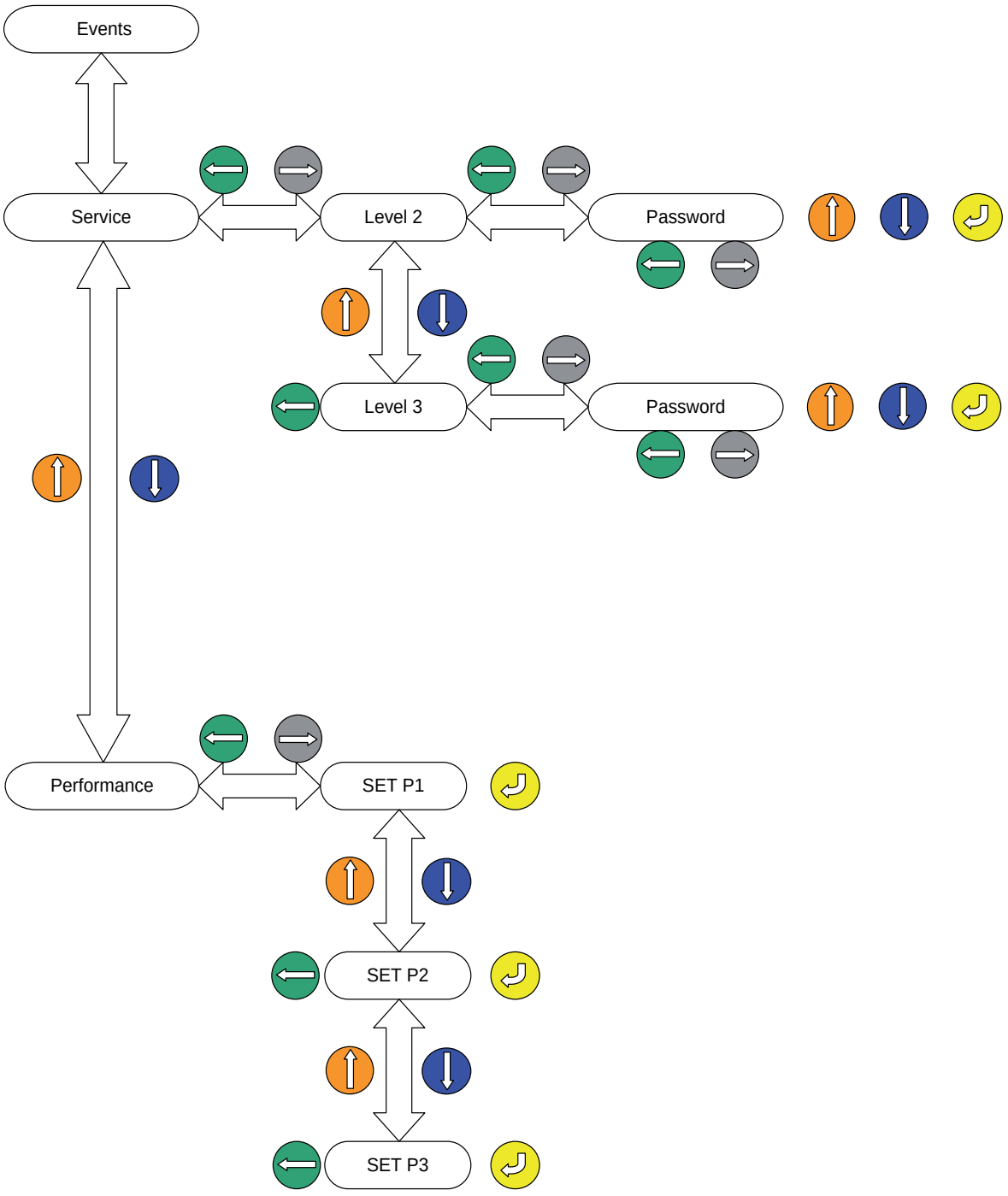


Continued on page 55

TC436

Operator Menu

From page 54



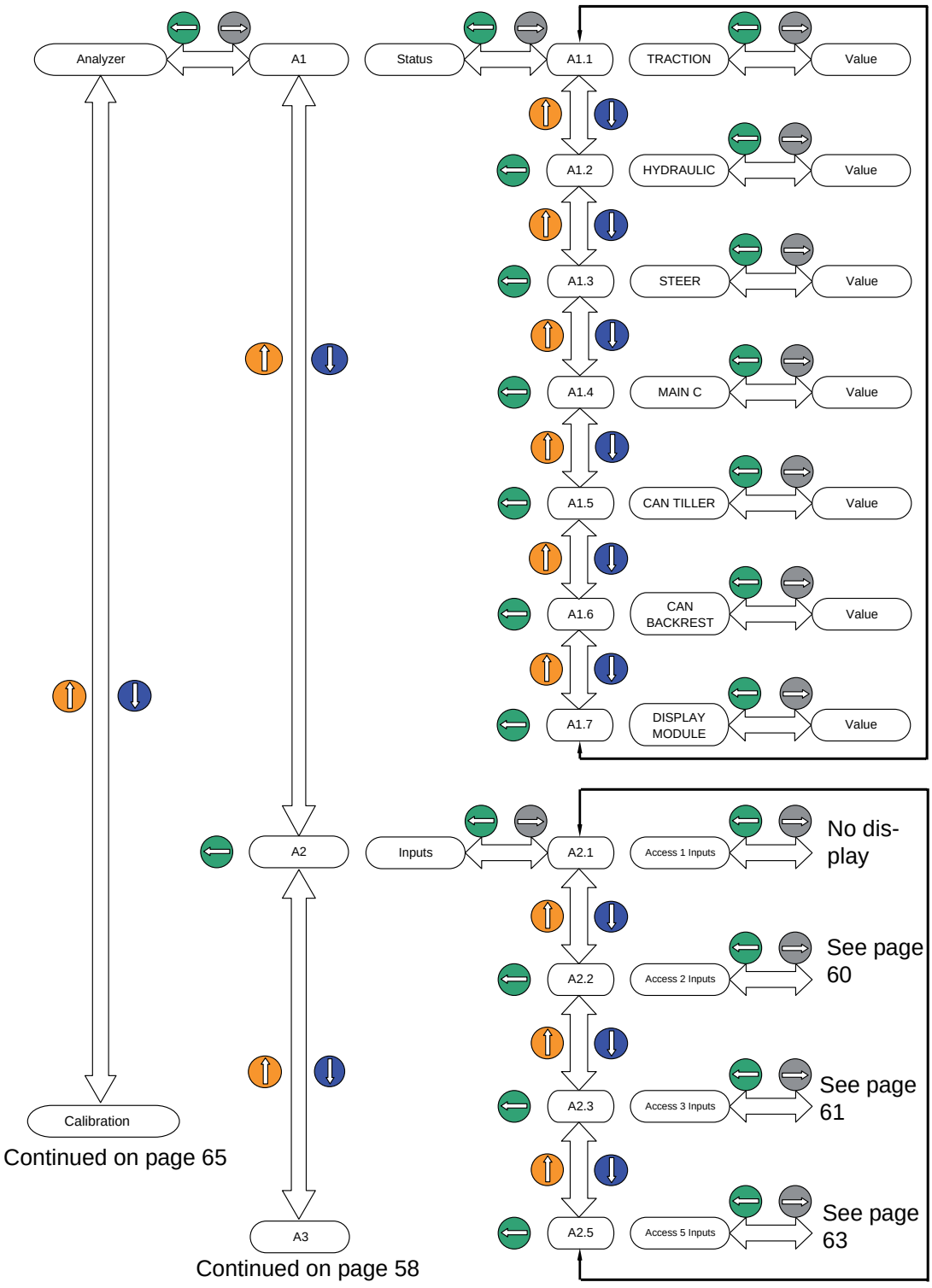
TC437

Analyzer Menu Overview

A 1 Status	
A 1.1	Traction
A 1.2	Hydraulics
A 1.3	Steer
A 1.4	Main C
A 1.5	CAN Tiller
A 1.6	CAN Backrest
A 1.7	Display Module
A 2 Inputs	
A 2.1	Access 1 Inputs
A 2.2	Access 2 Inputs
A 2.2.1	RAS Switch
A 2.2.2	LOS 1 Switch
A 2.2.3	RAS 2 + 3 Switch
A 2.2.4	LOS 2 + 3 Switch
A 2.2.5	LMS 5 Sensor
A 2.2.6	LMS 6 Sensor
A 2.2.7	LMS 8 Switch
A 2.2.8	LMS 9 Sensor
A 2.2.9	LMS 10 Sensor
A 2.2.10	Pressure Transducer
A 2.2.11	Pump Motor Current
A 2.2.12	Pump On
A 2.3	**Access 3 Inputs**
A 2.3.1	Temp Access 3
A 2.3.2	TS 1
A 2.3.3	FWD Switch
A 2.3.4	REV Switch
A 2.3.5	POT WPR
A 2.3.6	HSS Switch
A 2.3.7	HNS 1 + 2 Switches
A 2.3.8	BRS Switch
A 2.3.9	FPS 1 Sensor
A 2.3.10	FPS 2 Sensor

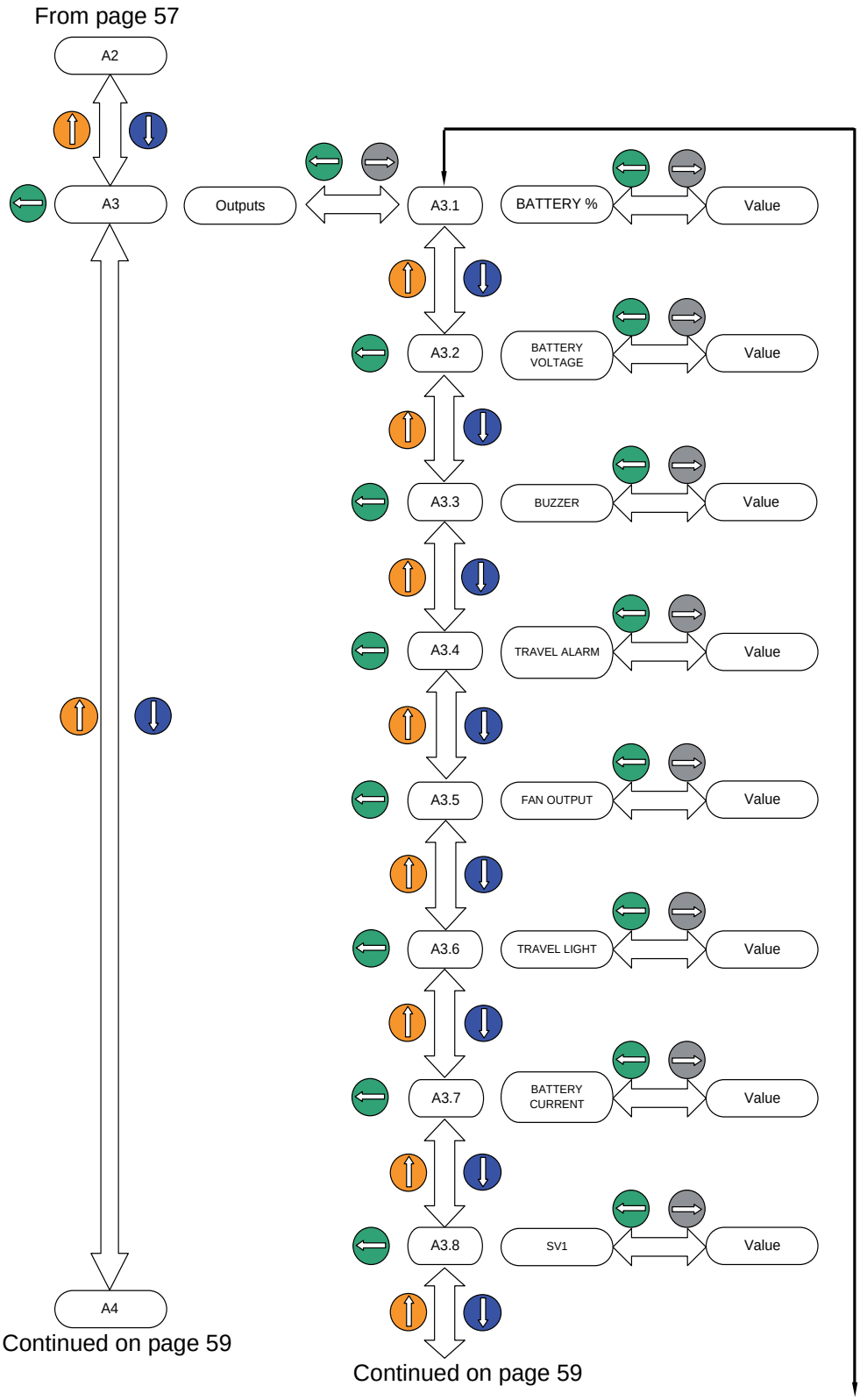
A 2.3	**Access 3 Inputs**
A 2.3.11	HPCS 1 Switch
A 2.3.12	HPCS 2 Switch
A 2.3.13	HPCS 3 Switch
A 2.3.14	HPCS 4 Switch
A 2.3.15	Traction Motor Current
A 2.3.16	ECR 1 Encoder 64P
A 2.3.17	LMS 7 + 7.1 Sensors
A 2.3.18	BLS Switch
A 2.5 Access Inputs	
A 2.5.1	Temp Access 5
A 2.5.2	TS 3 (Temp Motor)
A 2.5.3	Steer Mot Current
A 2.5.4	Steer POT 1
A 2.5.5	Steer POT 2
A 2.5.6	ECR2 (Encoder 32P)
A 2.5.7	ECR3 (Encoder 48P)
A 2.5.8	Straight Ahead Sensor
A 3 Outputs	
A 3.1	Battery %
A 3.2	Battery Voltage
A 3.3	Buzzer
A 3.4	Travel Alarm
A 3.5	Fan Output
A 3.6	Travel Light
A 3.7	Battery Current
A 3.8	SV 1
A 3.9	SV 2
A 3.10	PV
A 3.11	Brake Output
A 3.12	Horn Output
A 3.13	Traction Speed
A 3.14	RPM Traction Motor
A 3.15	RPM Steer Motor
A 4 Test Outputs	
A 4.1	FN 1

Analyzer Menu - Status & Inputs



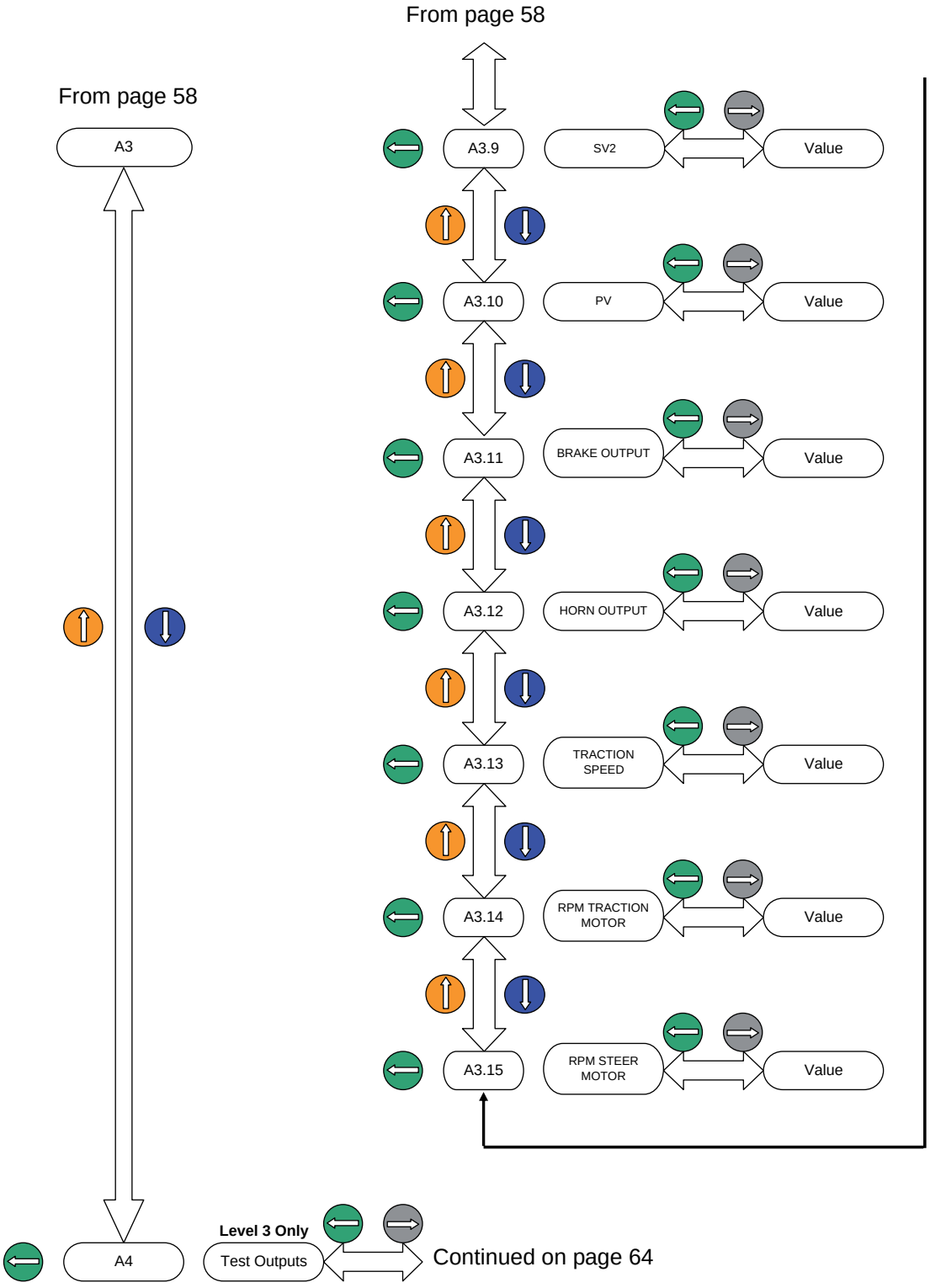
TC438

Analyzer Menu - Outputs



TC439

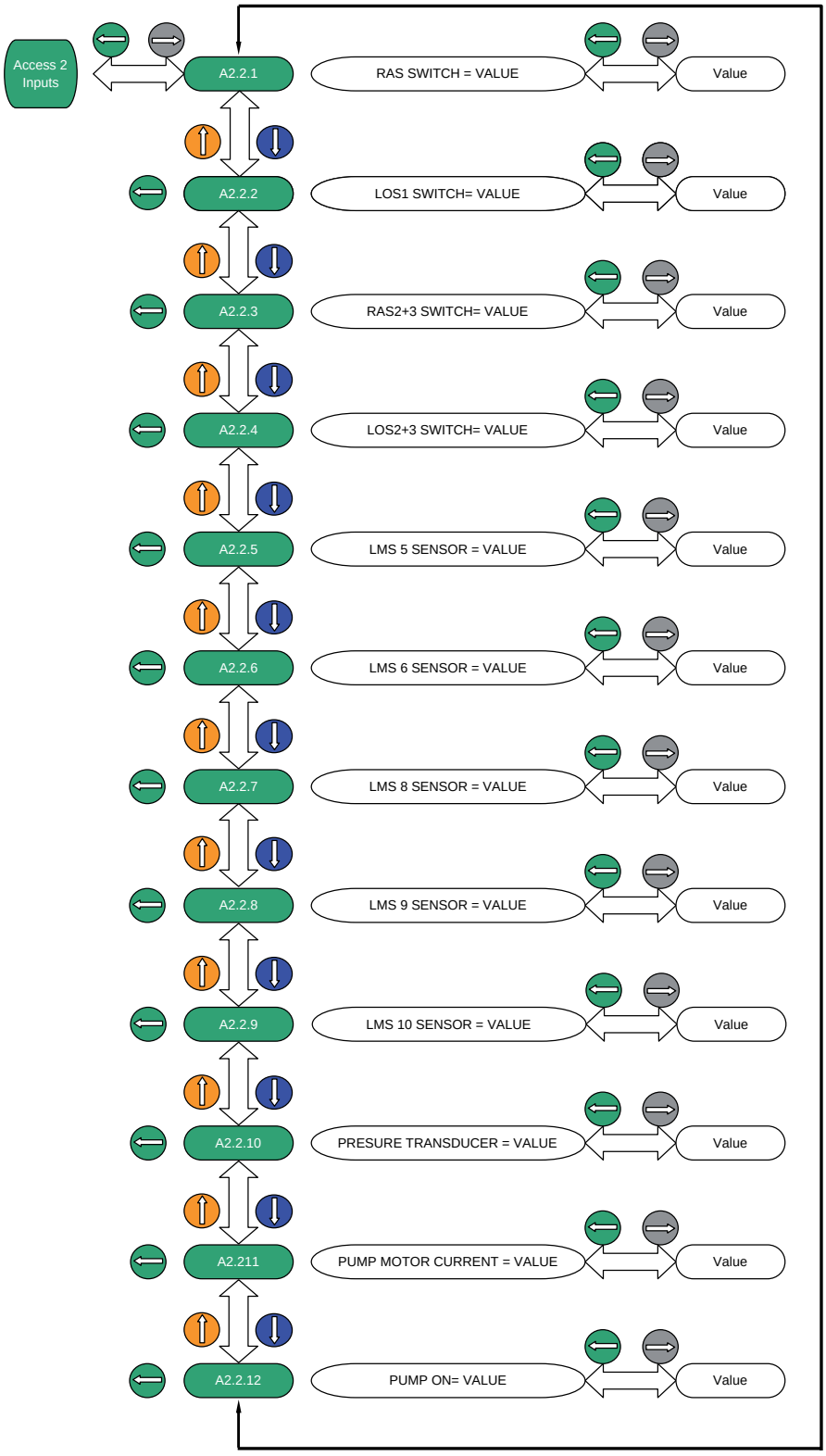
Analyzer Menu - Outputs



TC440

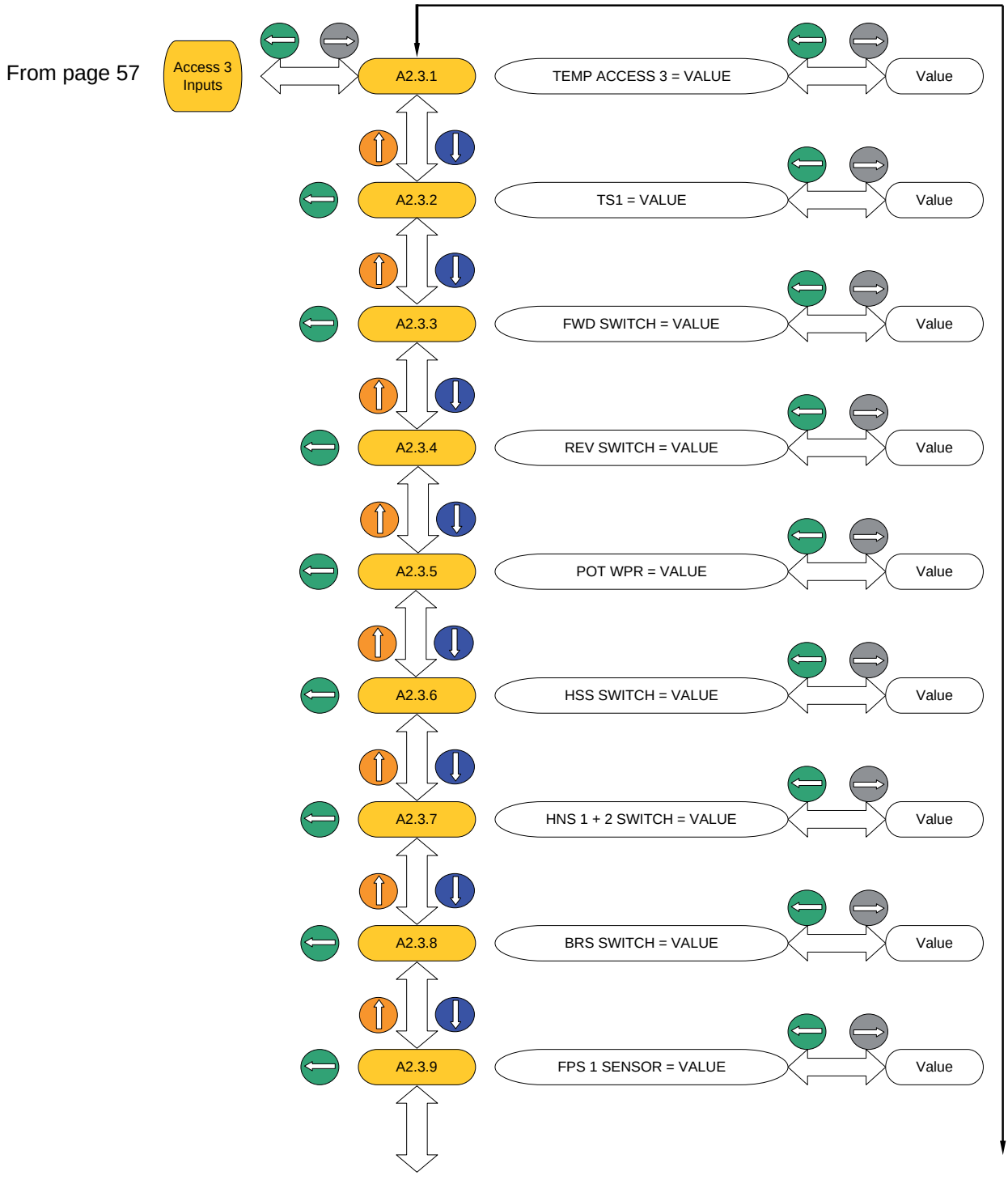
Analyzer Menu - Access 2 Inputs

From page 57



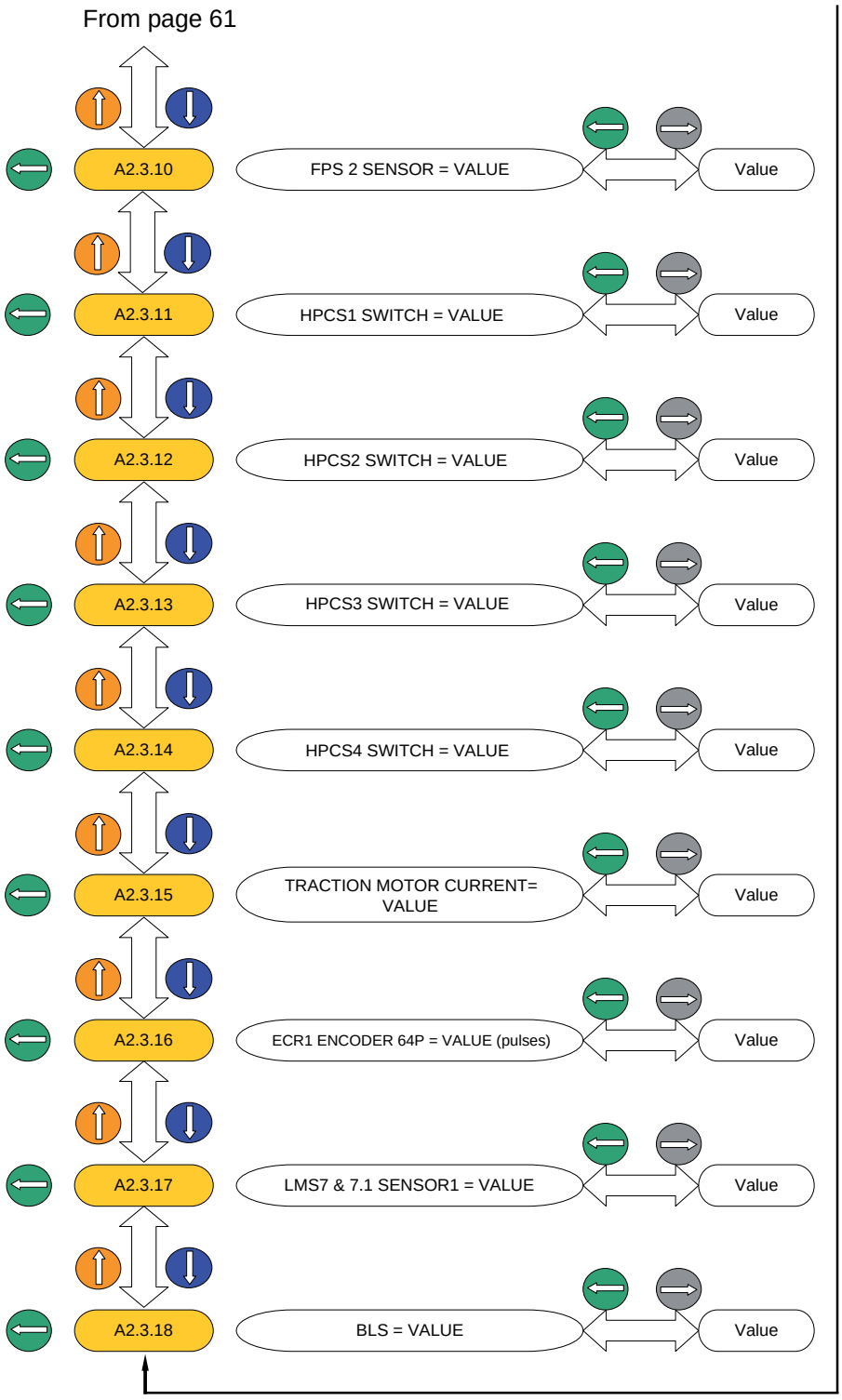
TC441

Analyzer Menu - Access 3 Inputs



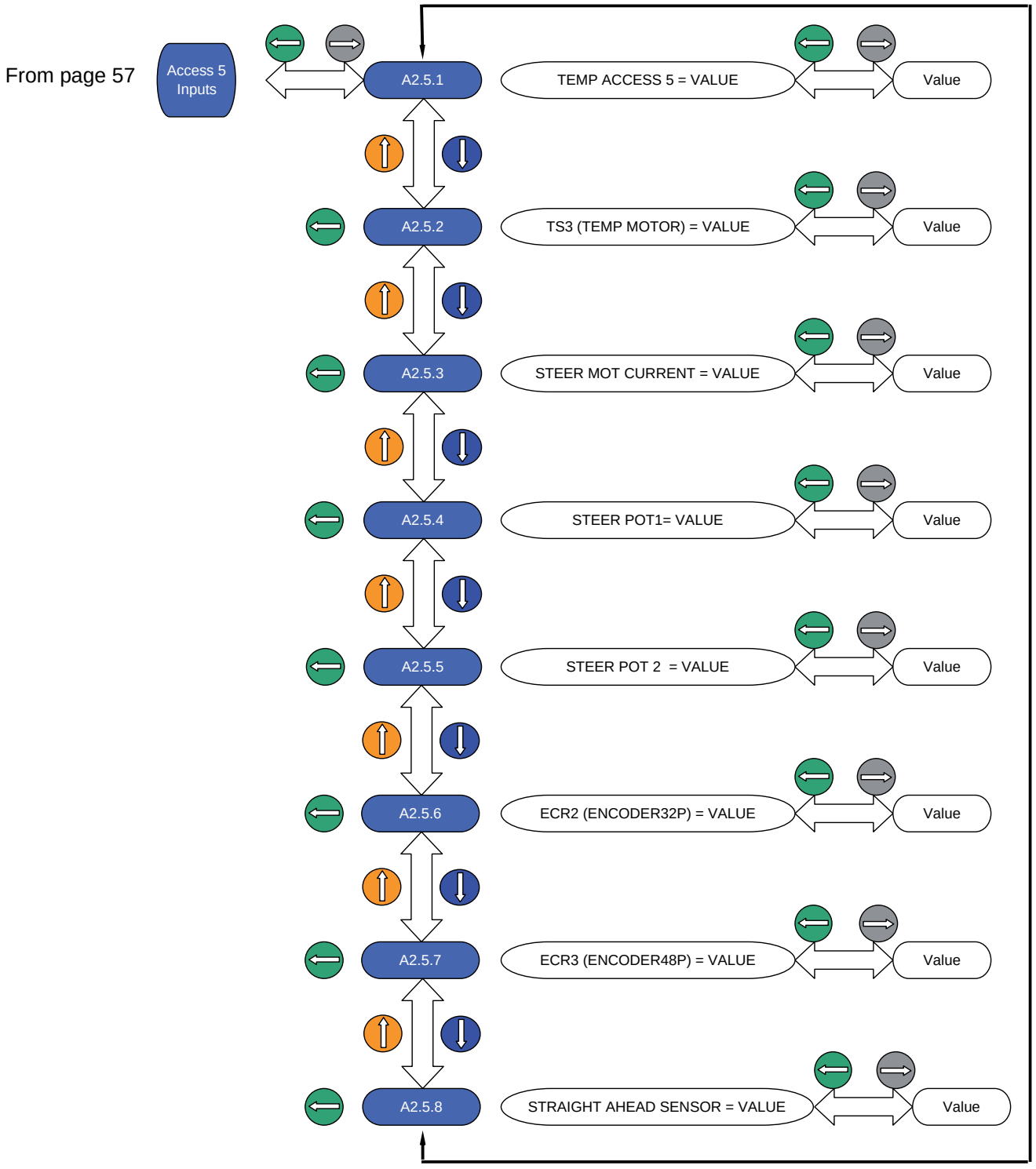
TC442

Analyzer Menu - Access 3 Inputs



TC443

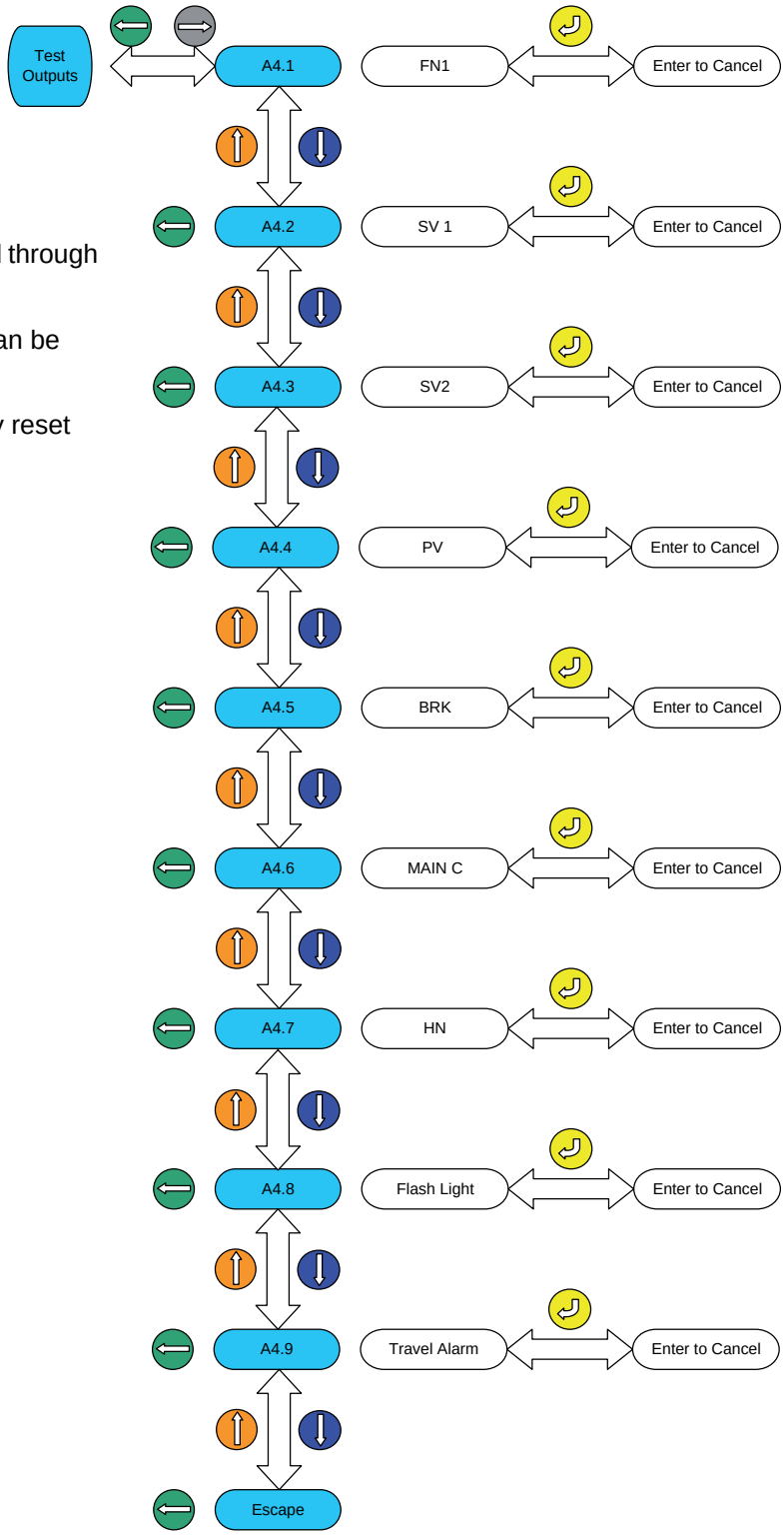
Analyzer Menu - Access 5 Inputs



TC444

Analyzer Menu - Test Outputs

From page 59



Note:

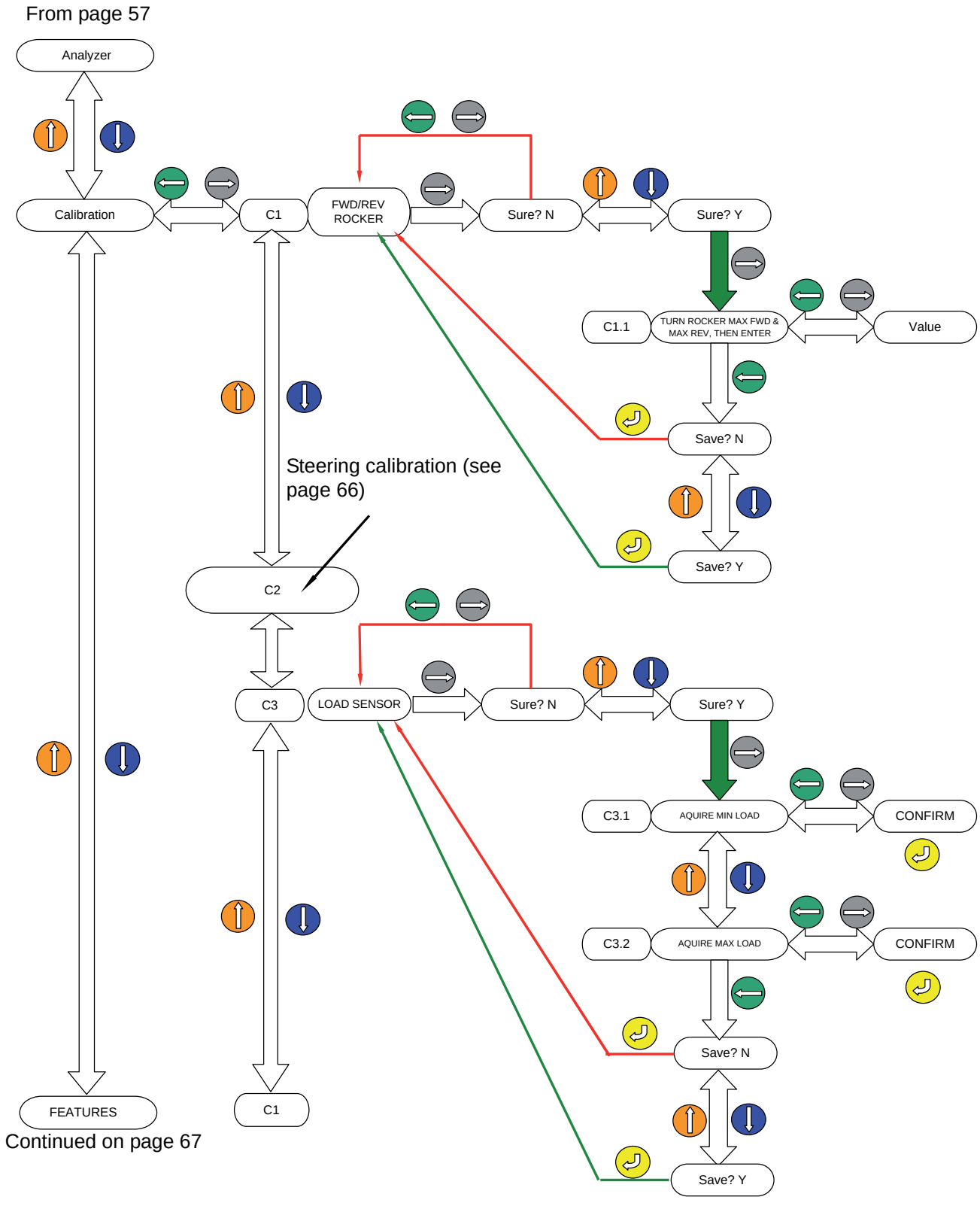
1. Test outputs can only be reached through service level 3.

2. Currently, only item A4.1 (fan) can be activated.

3. All test outputs are automatically reset after 5 seconds.

TC445

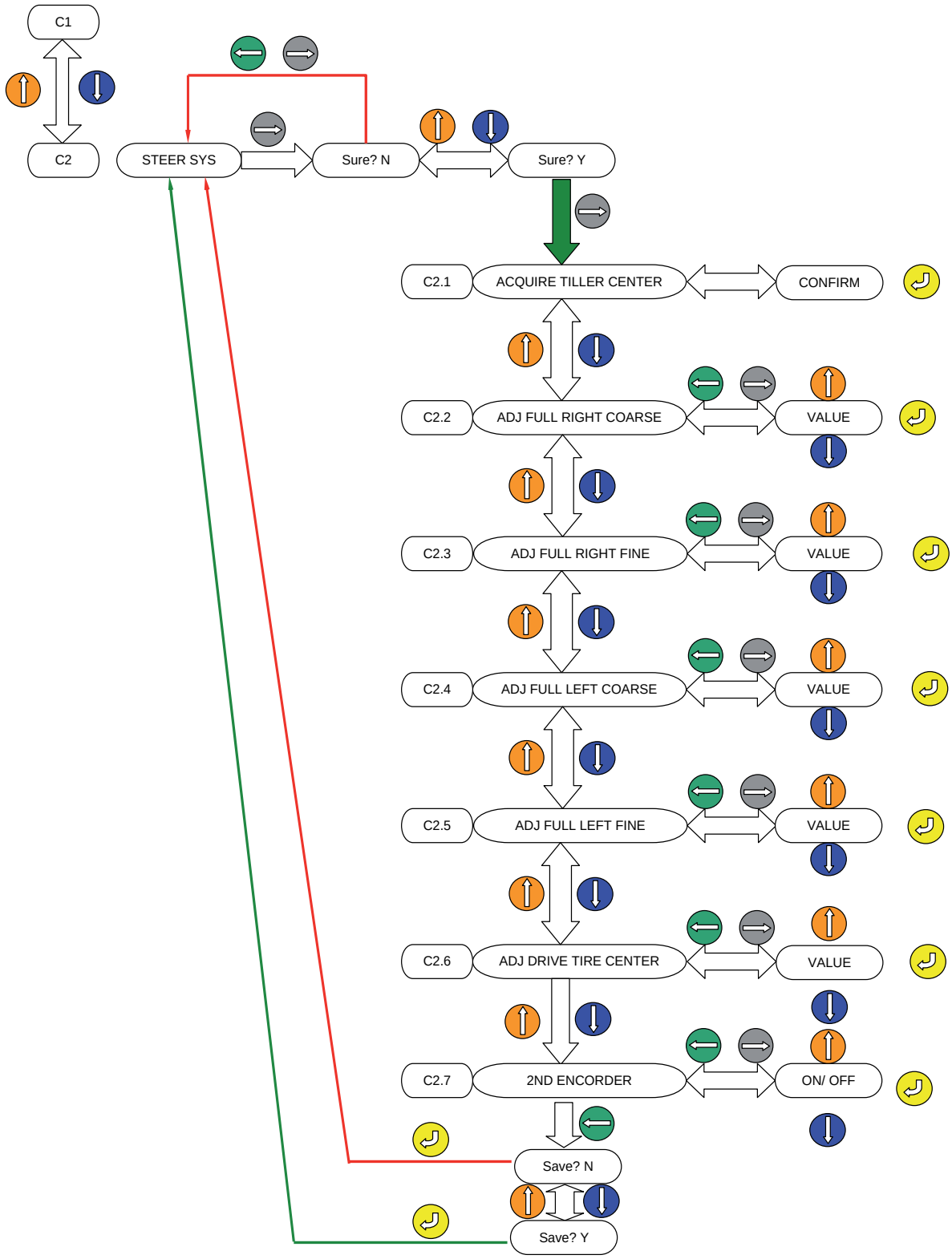
Calibration - Rocker & Load Sensor



TC446

Calibration - Steer System

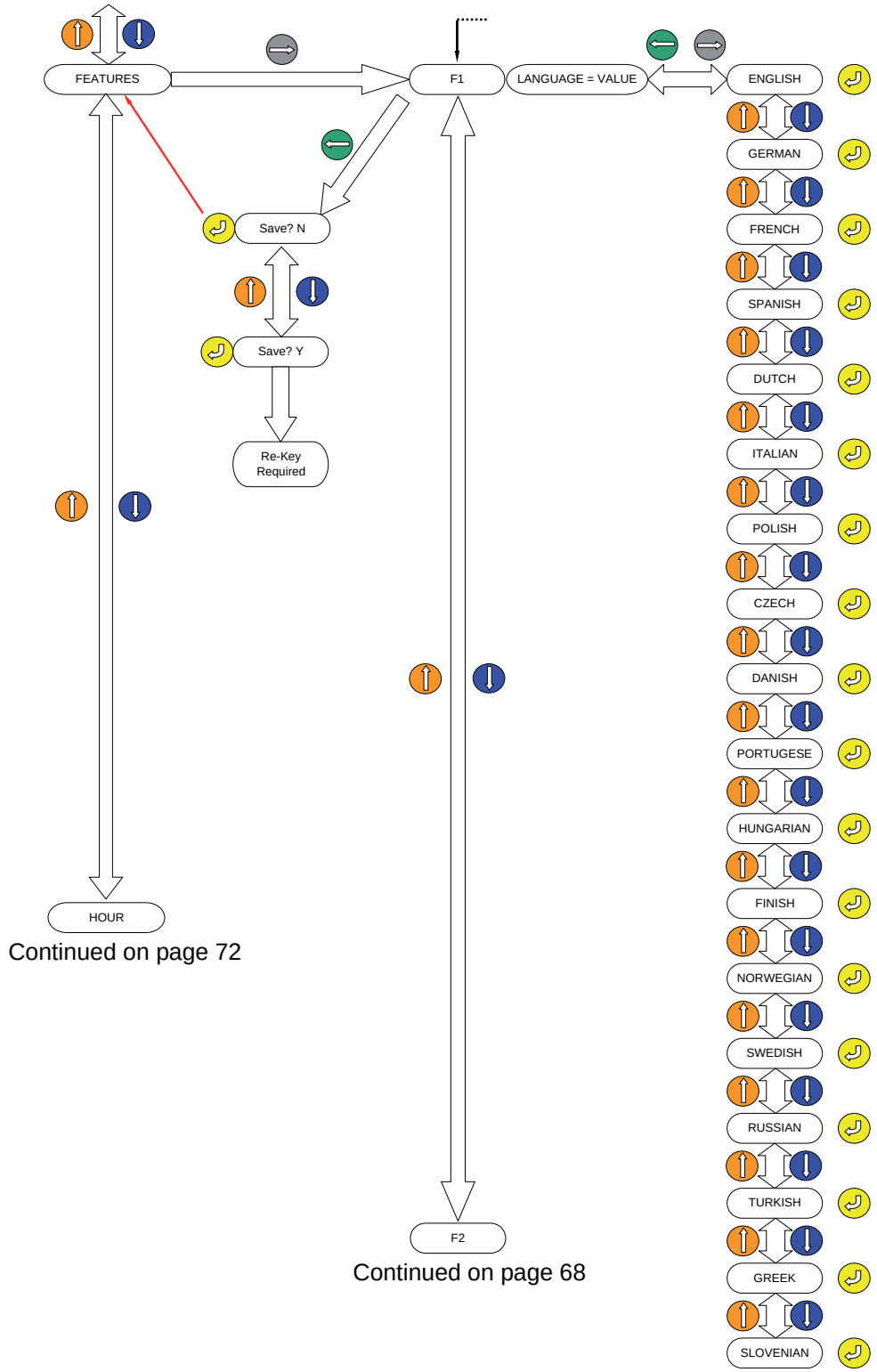
From page 65



TC447

Features

From page 65



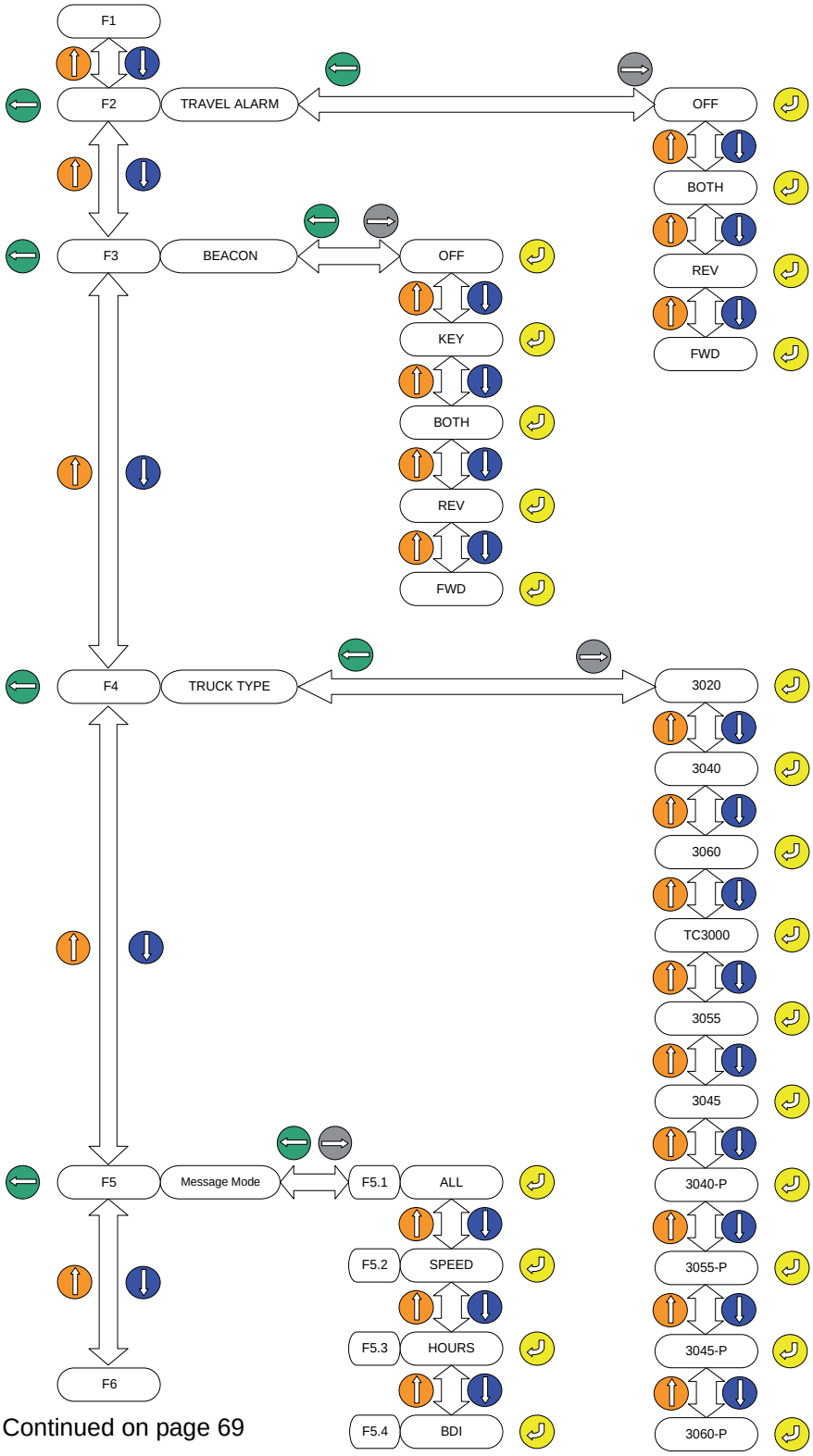
Continued on page 72

Continued on page 68

TC448

Features

From page 67

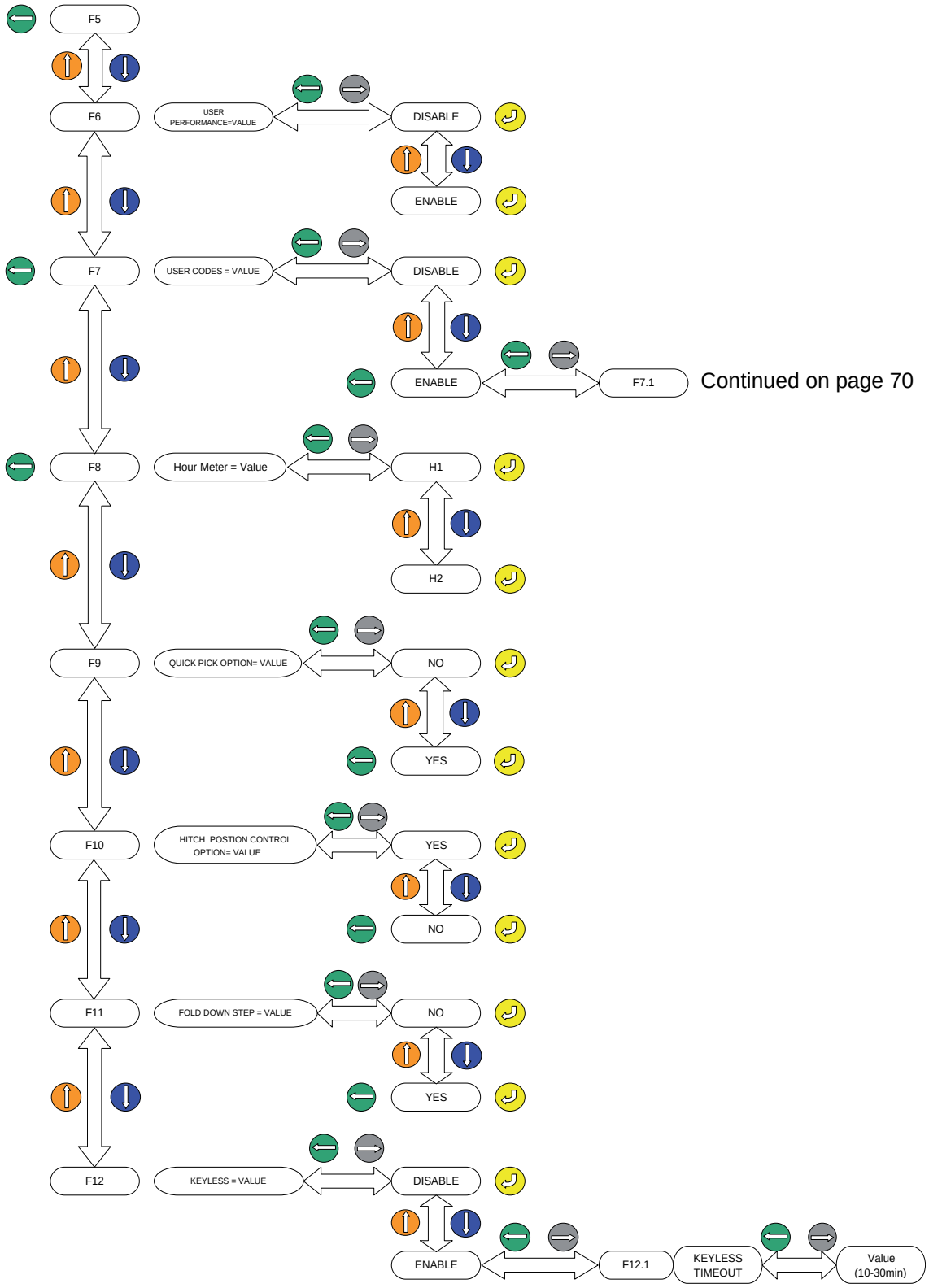


Continued on page 69

TC449

Features

From page 68

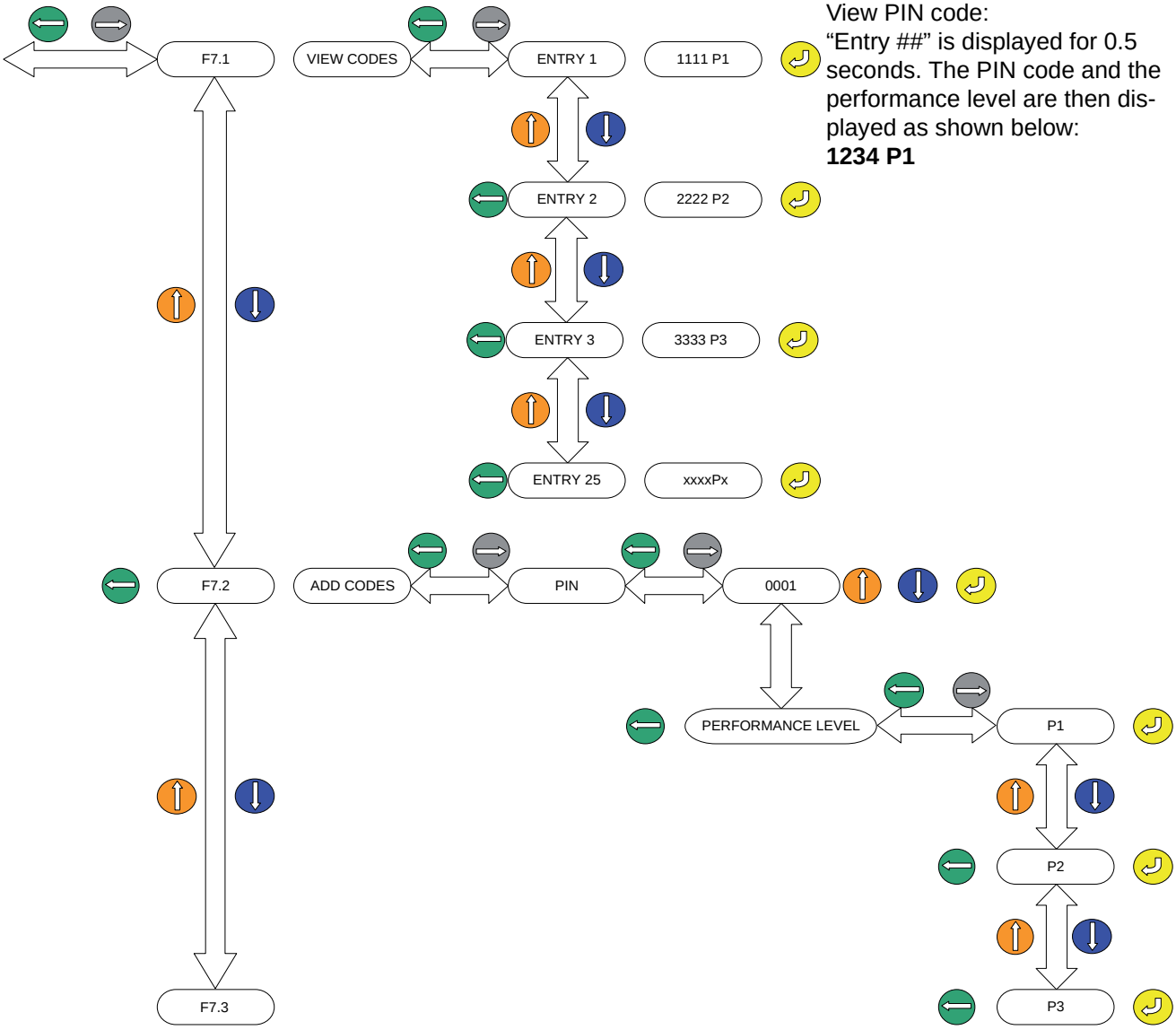


Continued on page 70

TC450

Features

From page 69



View PIN code:
"Entry ##" is displayed for 0.5 seconds. The PIN code and the performance level are then displayed as shown below:
1234 P1

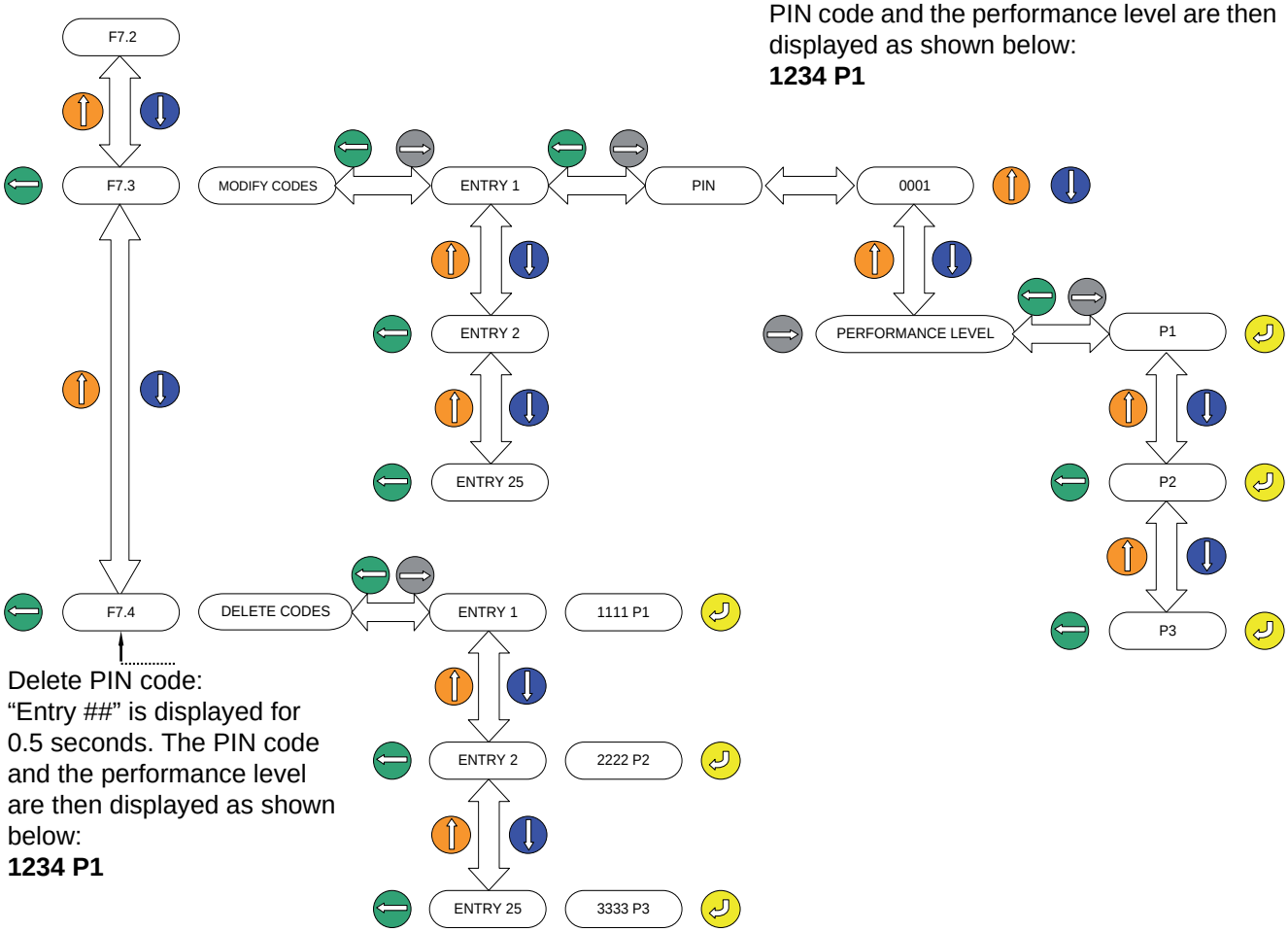
Continued on page 71

TC451

Features

From page 70

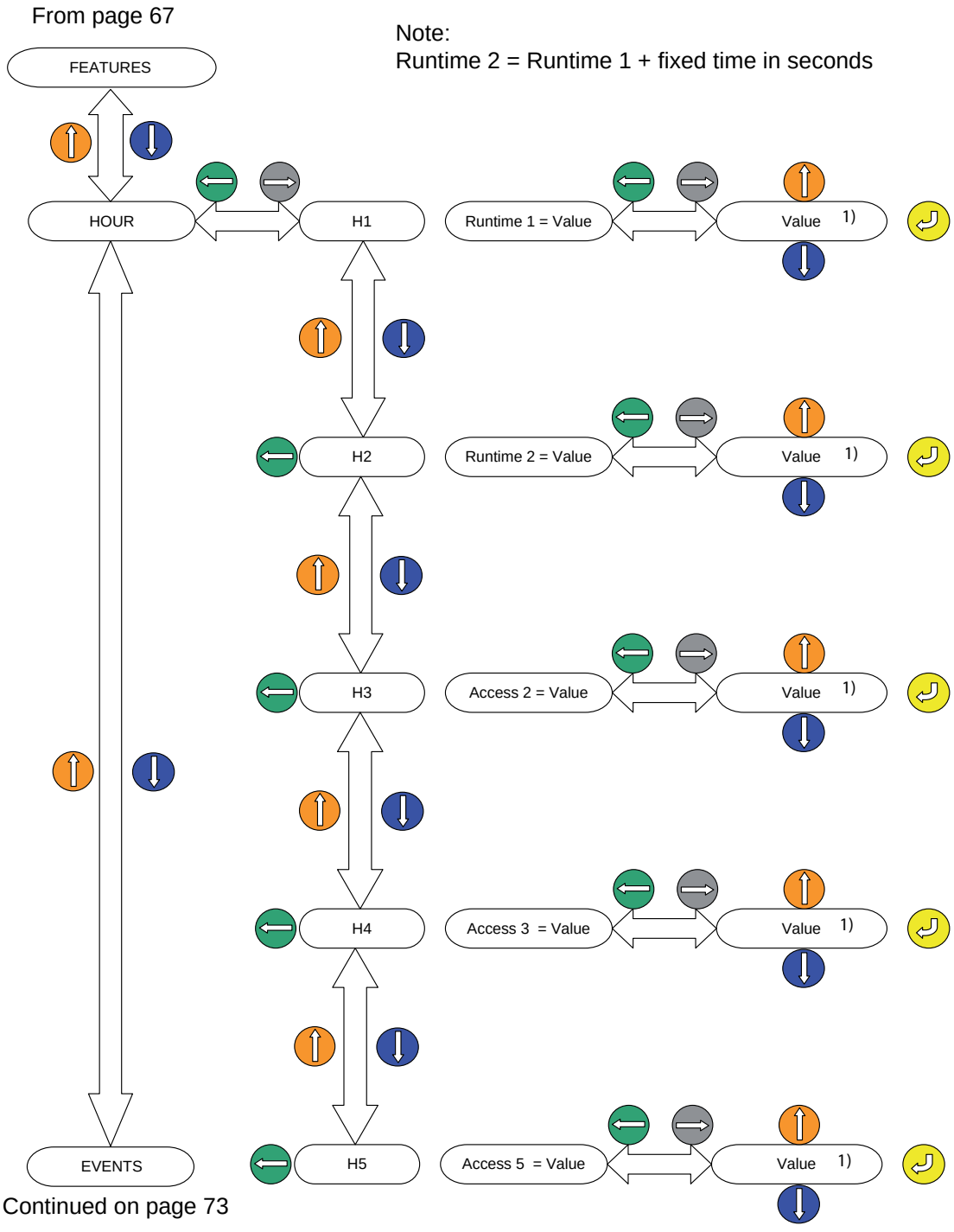
Modify PIN code:
“Entry ##” is displayed for 0.5 seconds. The PIN code and the performance level are then displayed as shown below:
1234 P1



Delete PIN code:
“Entry ##” is displayed for 0.5 seconds. The PIN code and the performance level are then displayed as shown below:
1234 P1

TC452

Hours

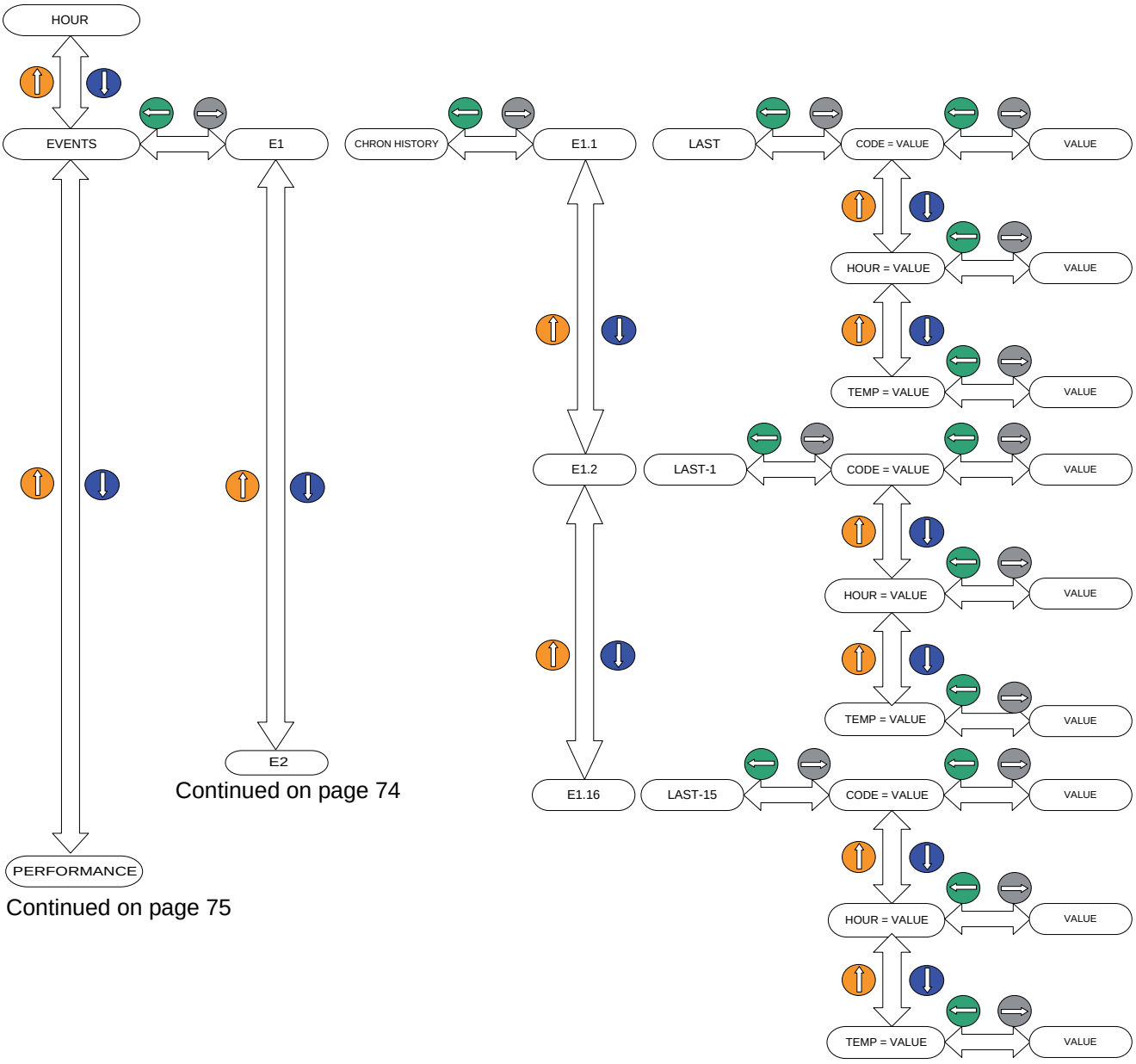


TC453

1) The setting cannot be changed in service level 2. It can be increased but not decreased in service level 3.

Events

From page 72



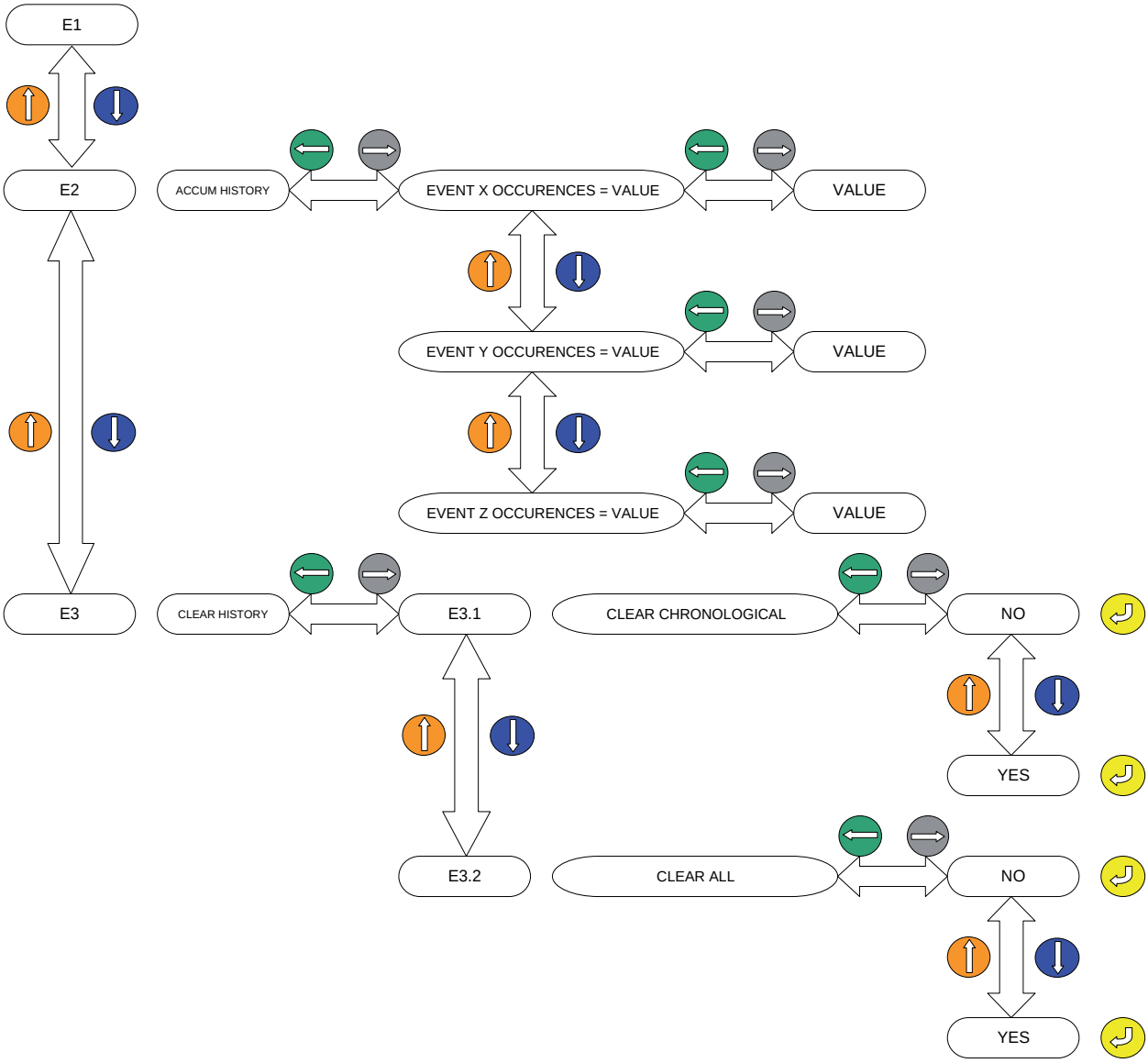
Continued on page 74

Continued on page 75

TC454

Events

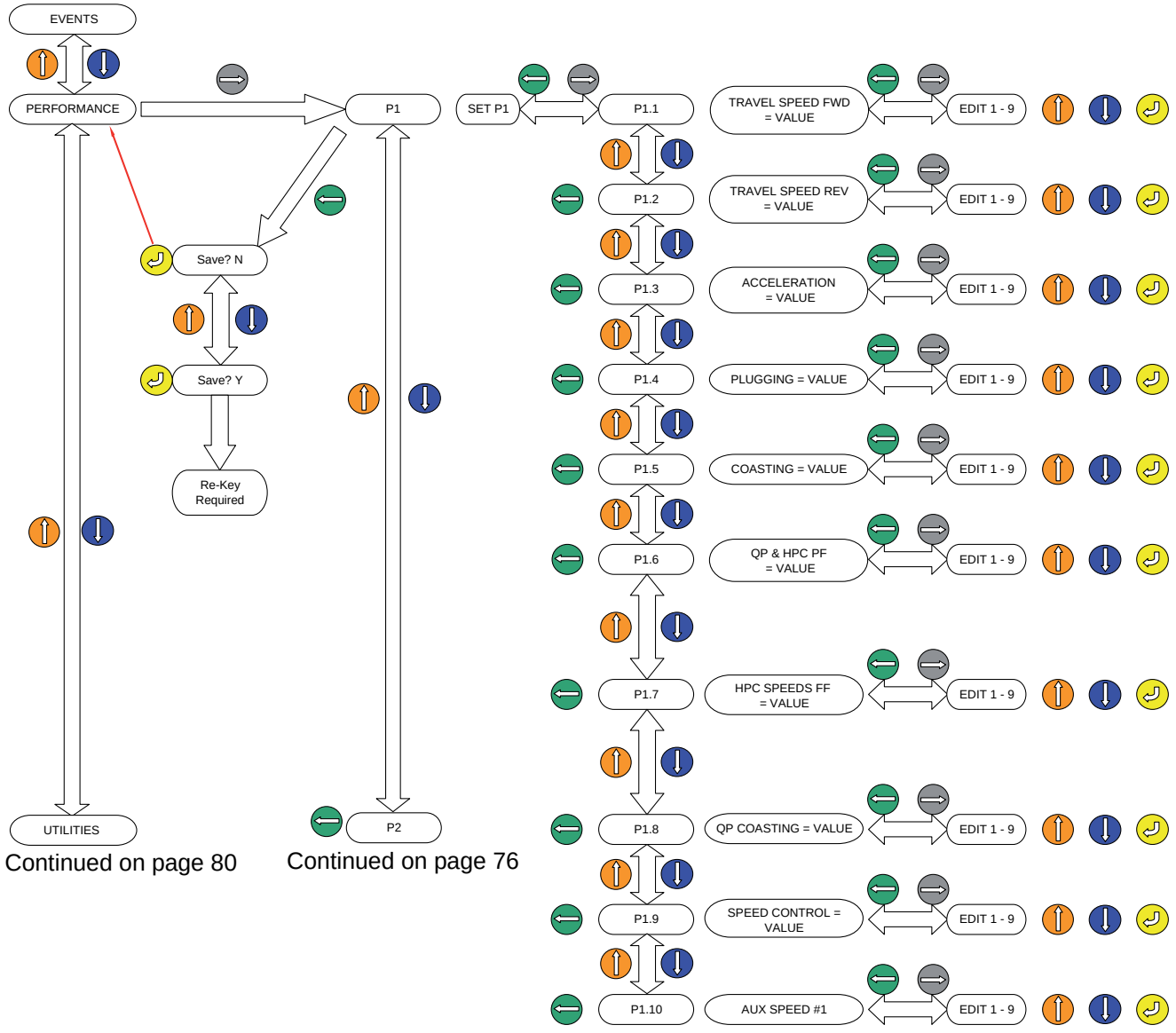
From page 73



TC455

Performance

From page 73



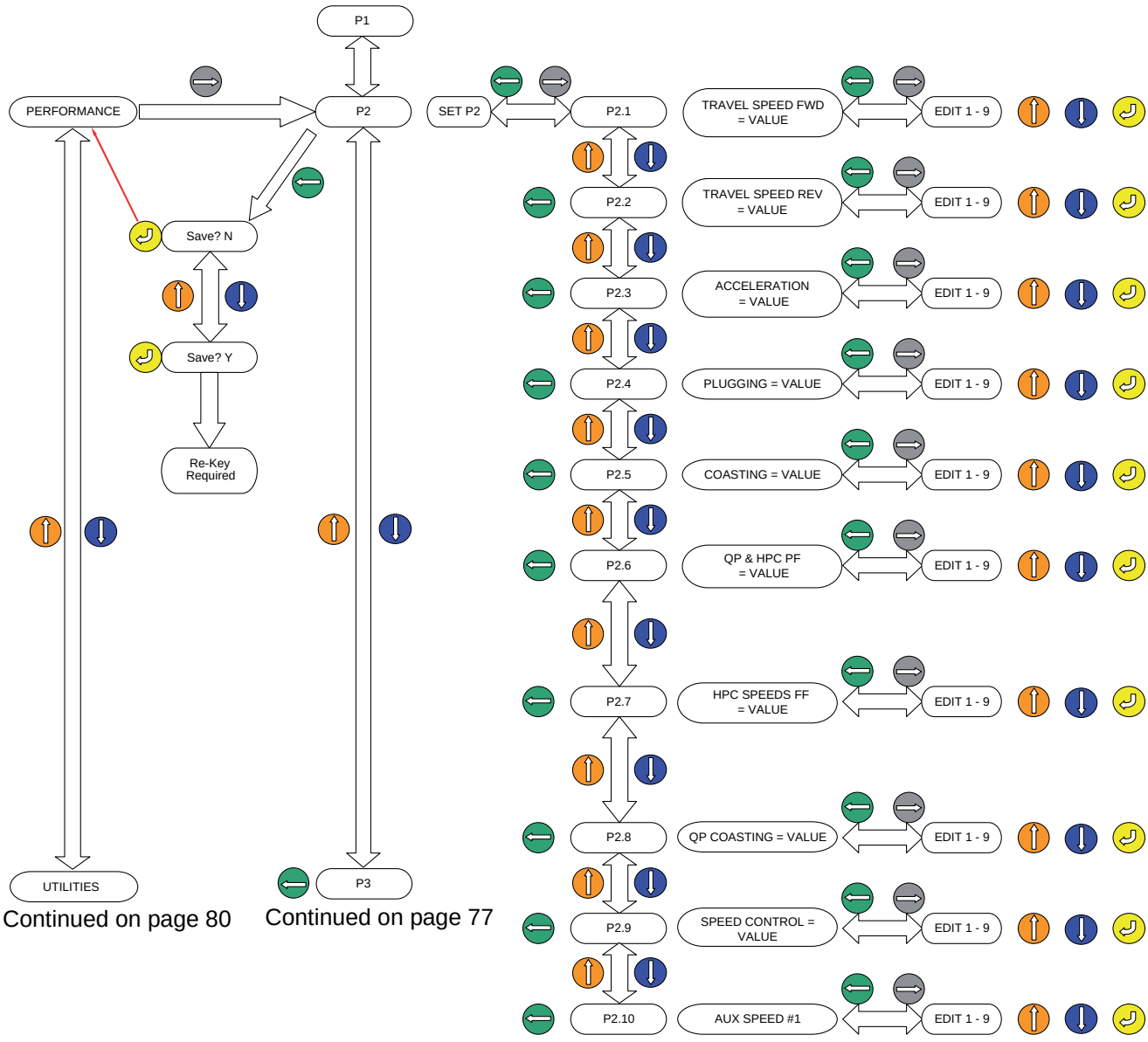
Continued on page 80

Continued on page 76

TC456

Performance

From page 75



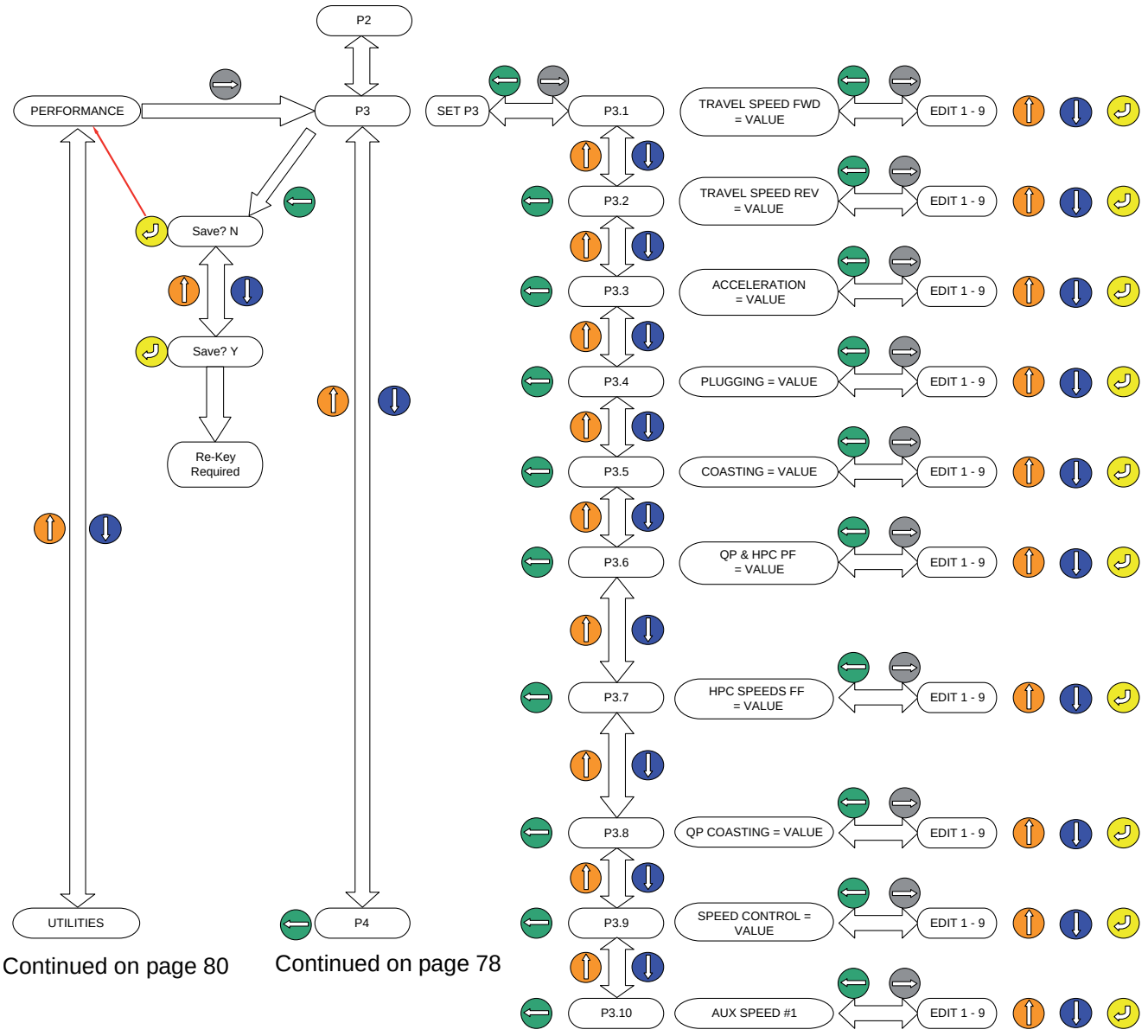
Continued on page 80

Continued on page 77

TC457

Performance

From page 76



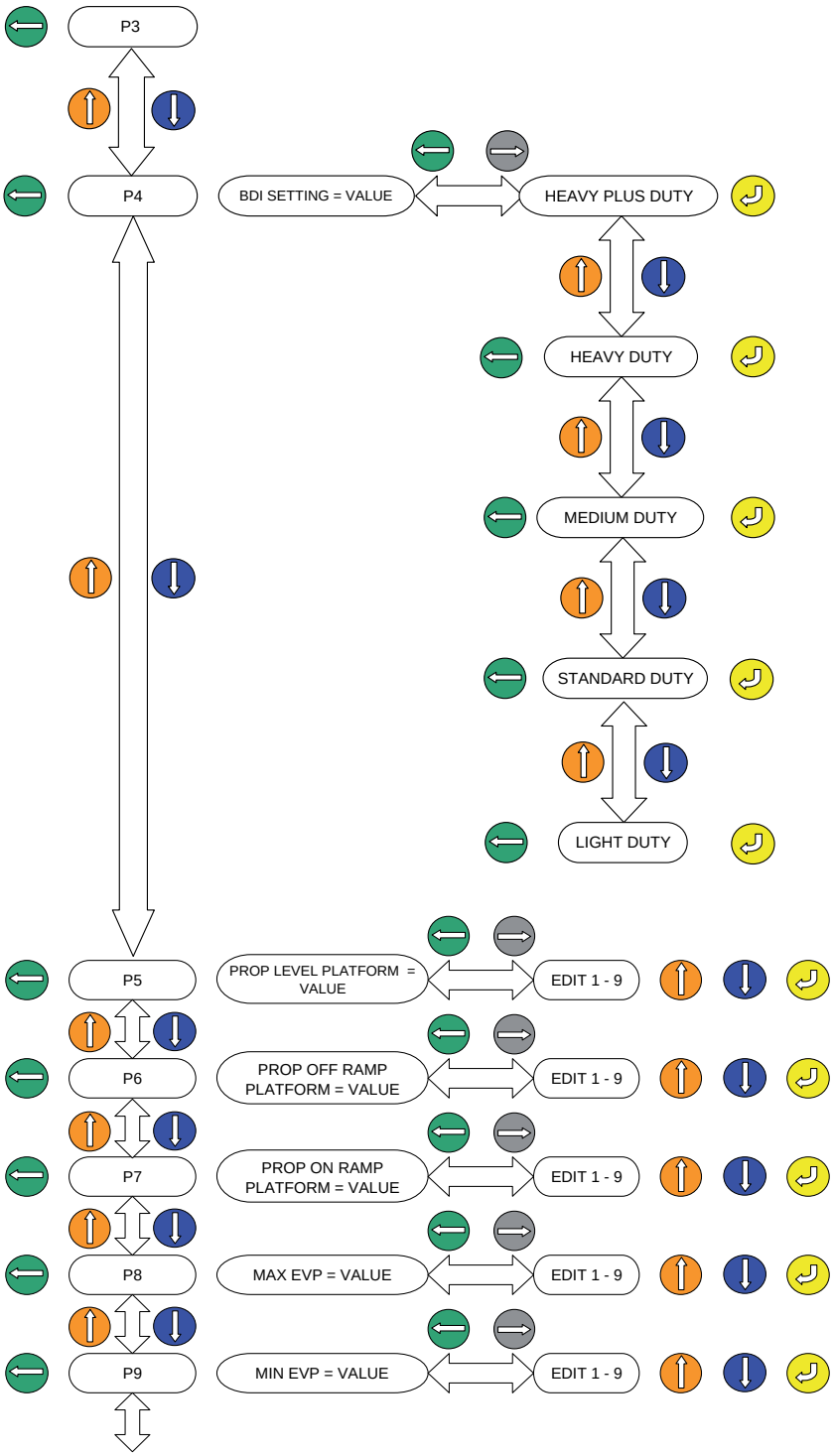
Continued on page 80

Continued on page 78

TC458

Performance

From page 77

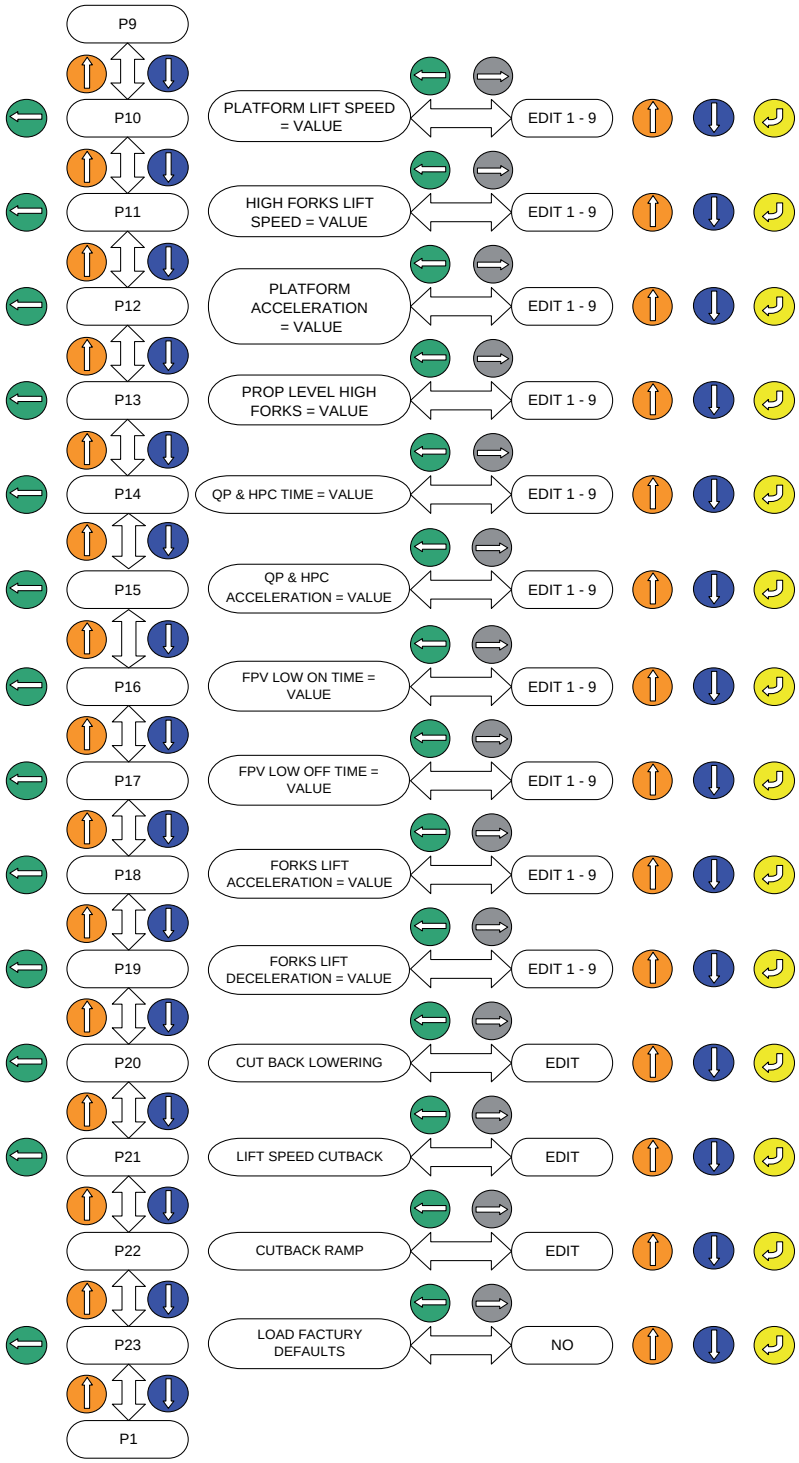


Continued on page 79

TC459

Performance

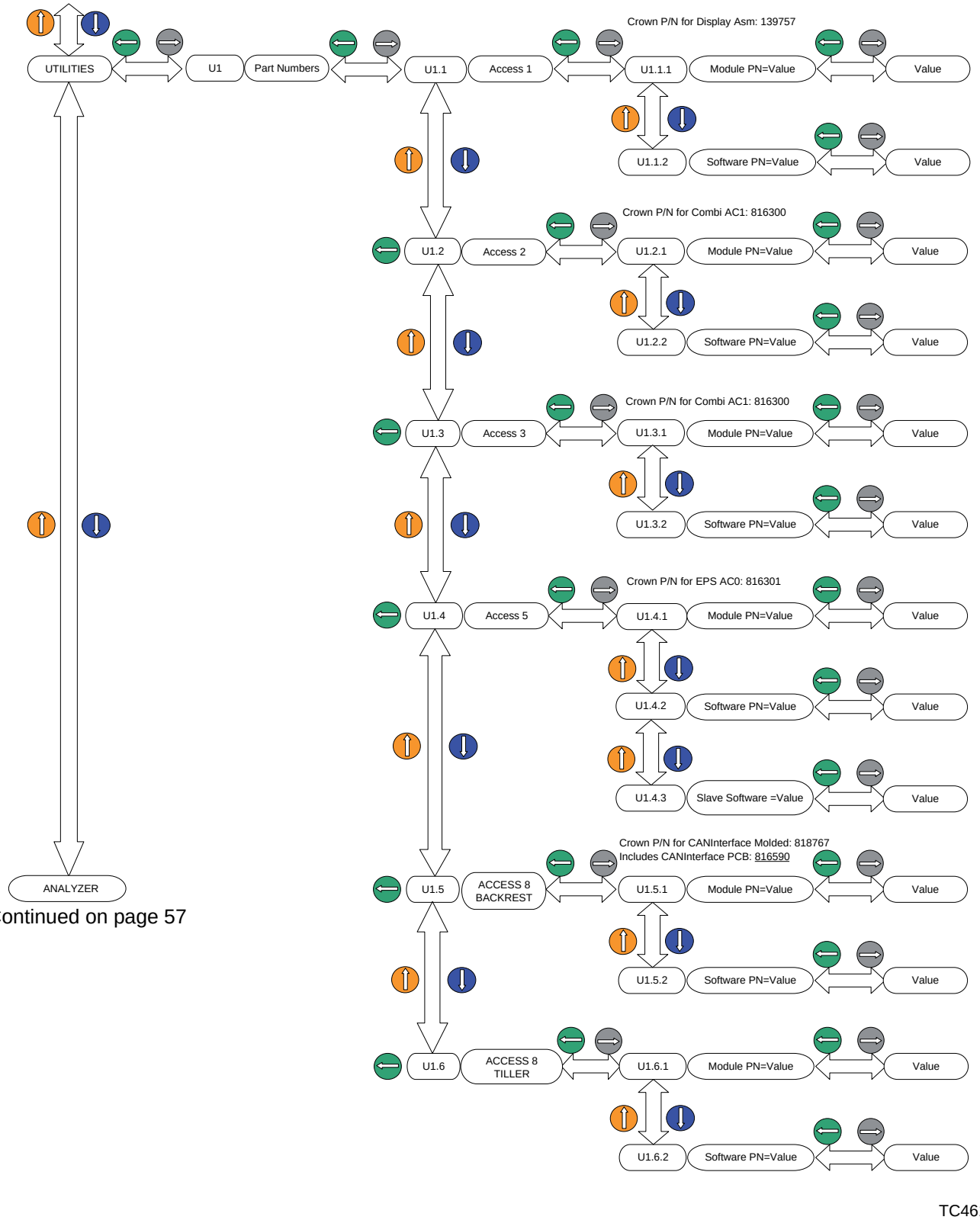
From page 78



Continued on page 75

Utilities

From page 77



Continued on page 57

TC461

Parameter Setting

The travel and braking patterns of the truck can be adapted within limits to suit the customer's requirements.

Display	Description	Factory Settings		
		Performance level 1	Performance level 2	Performance level 3
Travel Speed FWD	Max. forward speed of the unladen truck (battery first). Speeds can be set from 1-9; from 6.0 km/h to 10 km/h.	9	9	9
Travel Speed REV	Max. reverse speed of the unladen truck (tow hitch first). Speeds can be set from 1-9; from 6.0 km/h to 10 km/h.	6	6	6
Acceleration	Time required for the unladen truck to accelerate forward to 8.8 km/h. Settings from 1-9, corresponding to 1.6/1.8/2.0/2.2/2.4/3.0/3.5/4.0/4.5 seconds.	8	8	8
Plugging	Time required to brake from 8.8 km/h to 0 km/h when the travel direction is changed (plugging). Settings from 1-9, corresponding to 0.7/0.8/0.9/1.0/1.1/1.2/1.3/1.4/1.5/1.6 seconds.	2	2	2
Coasting	Time required to brake from 8.8 km/h to 0 km/h when the travel switch is released (coasting). Settings from 1-9, corresponding to 1.3/1.4/1.5/1.6/1.7/1.8/2.0/2.2/2.4/2.6 seconds.	4	4	4
QP speed PF	Max. forward speed of unladen truck in "Quick Pick" mode. Settings from 1-9, corresponding to 2.8/3.2/3.6/4.0/4.4/4.8/5.2/5.6/6.0 km/h.	6	6	6
QP Time	Length of time the truck remains in “Quick Pick” mode. Settings from 1-9, corresponding to 1/2/3/4/5/6/7/8/9/10 seconds.	9	9	9
QP Coasting	Time the truck takes to decelerate from the "QP Speed PF" speed to 0 km/h. Settings from 1-9, corresponding to 0.5/0.7/0.9/1.1/1.3/1.5/1.7/1.9/2.1/2.3 seconds.	9	9	9
QP Acceleration	Time taken in seconds for the unladen truck to accelerate in "Quick Pick" mode to the pre-set forward speed. Settings from 1-9, corresponding to 1.4/1.6/1.8/2.0/2.2/2.4/2.6/2.8/3.0 seconds.	1	1	1

Calibration

Calibration is performed in the “SERVICE” menu under the “CALIBRATION” menu item on the display. To select the “CALIBRATION” menu proceed as follows:

Selecting the CALIBRATION Menu

You can navigate through the menu structures using the cursor keys (↵, ◀, ▶, ▲, ▼) on the display. An overview of the menu structure can be found in *Electrical System, on page 57*.

TC403

1. Turn the key switch right to the "On" position.
   – The display screen is activated.

Note: On trucks without a key switch, press the ↵ key for one second until the display screen is activated.

2. Press the ▼ key until the “SERVICE” menu appears.
3. Press the ▶ key until “LEVEL 2” appears.
4. Press the ▶ key until you are requested to enter your PIN.
5. Enter the Service PIN using the ▲ and ▶ keys and press ↵.
   – The service menu is now selected and the "ANALYZER" menu is displayed.
6. Press the ▼ key until the “CALIBRATION” menu appears.
7. Using the ▶ key select the first sub-menu.
   – The “C1 FWD/REV ROCKER” menu for calibrating the traction potentiometer is selected.
   – Use the ▼ key to select the “C2 STEER SYS” menu to calibrate the steer sensor and “C3 LOAD SENSOR” to calibrate the load sensor.

Calibrating the Traction Potentiometer

- Jack up the truck (see page 14).
- The “CALIBRATION” menu is selected (see “Selecting the CALIBRATION Menu” on page 82).

1. Press the ▶ key until the “C1 FWD/REV ROCKER” menu appears.
2. Press the ▶ key.
   – The security question “SURE YES/NO” for calibrating is displayed.
3. To continue calibrating, press ▼ “Y” (**Y**es).
4. Press the ▶ key.
   – The prompt “TURN ROCKER MAX FWD & MAX REV. THEN ENTER” appears.
5. Move the travel switch forward as far as the stop, then back as far as the stop.
6. Confirm with ↵.
   – The prompt for saving the values “SAVE YES/NO” is displayed.
7. To save the values, press ▼ “Y” (**Y**es).
8. To quit the menu press ↵
   – The “C1 FWD/REV ROCKER" menu is selected.
9. Press ◀ to return to the “CALIBRATION” menu.
10. To activate the new settings, switch the truck off and on again.
11. Carry out a test run.

Steering Calibration

- Select the “CALIBRATION” menu (see “Selecting the CALIBRATION Menu” on page 82).

1. Using the ▶ key, select the “C1FWD/REV ROCKER” menu.
2. Press the ▼ key until the “C2 STEER SYS” menu appears.

3. Press the ▶ key.
   – The security question “SURE YES/NO” for calibrating is displayed.
4. To continue calibrating, press ▼ “Y” (**Y**es).
5. Press the ▶ key.
   – The “C2.1 ACQUIRE TILLER CENTER” menu for calibrating the tiller centre position is selected.

To calibrate the tiller centre position:

1. Set the tiller to the centre position.
2. To confirm the centre position press the ▶ key to select “CONFIRM” and press ↵.
3. Press the ▼ key.
   – The “C2.2 ADJUST FULL RIGHT COARSE” menu for calibrating the right steering angle is selected.

To perform a rough calibration of the right steering angle:

This calibration only provides a basic adjustment of the drive wheel with regard to the required position.

1. Move the tiller to the right as far as the stop and hold it in that position.
2. Press the ▶ key to view the setting (0 to 9).
3. Using keys ▲ and ▼, set the drive wheel roughly to the < 90 degree position.
4. Confirm the drive wheel position with ↵.
5. Press the ▼ key.
   – The “C2.3 ADJUST FULL RIGHT FINE” menu for fine-tuning the right steering angle is selected.

To fine-tune the right steering angle:

Fine-tuning is required to adjust the drive wheel exactly to the required position.

1. Move the tiller to the right as far as the stop and hold it in that position.
2. Press the ▶ key to view the setting (0 to 9).
3. Using keys ▲ and ▼, set the drive wheel exactly to the 90 degree position.
4. Confirm the drive wheel position with ↵.
   – The “C2.3 ADJUST FULL RIGHT FINE” menu is selected.
5. Press the ▼ key.
   – The “C2.4 ADJUST FULL LEFT COARSE” menu for calibrating the left steering angle is selected.

NOTE

The left steering angle is calibrated in the same way using the “C2.4 ADJUST FULL LEFT COARSE” and “C2.5 ADJUST FULL LEFT FINE” menus.

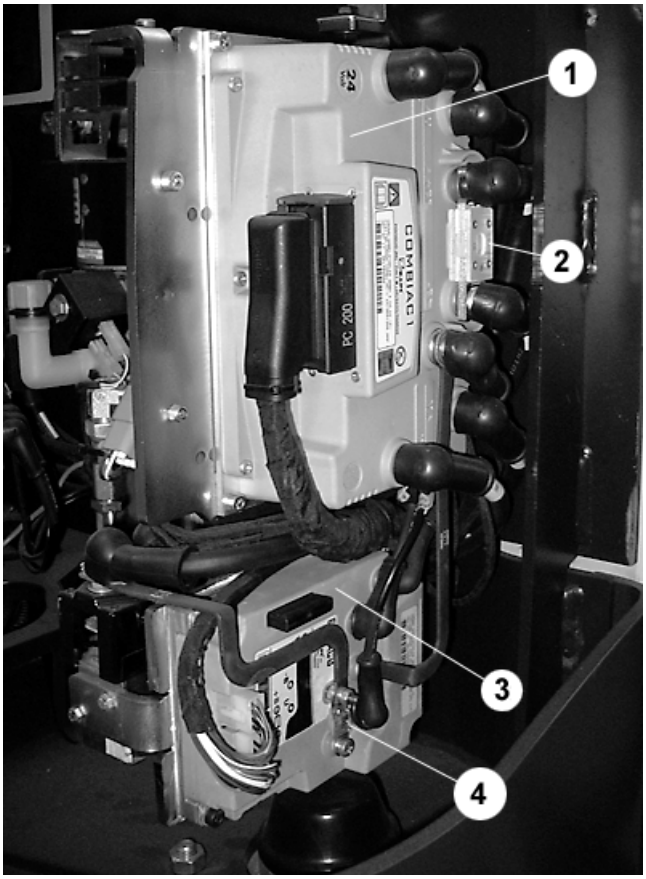
Calibrating forward travel:

1. Select the “C2.6 ADJUST DRIVE TIRE CENTER” menu using the ▼ key.
2. Press the ▶ key to view the setting.
   – The factory default setting for “Adjust Drive Tire Center” is 107.
3. Using keys ▲ and ▼, visually set the drive wheel to forward travel.
   – Carry out a test run to check whether the truck actually travels forward.
4. Confirm the drive wheel position with ↵.
   – The “C2.4 ADJUST FULL LEFT COARSE” menu is selected.
5. Press the ▼ key.
   – The “C2.7 2ND ENCODER” menu is selected.

Note: The “C2.7 2ND ENCODER” menu must not be changed. The encoder setting must be “ON”.

6. Press the ◀ key.
   – The prompt for saving the values “SAVE YES/NO” is displayed.
7. To save the values, press ▼ “Y” (**Y**es).
8. To quit the menu press ↵
   – The “C2 STEER SYS” menu is selected.
9. Press ◀ to return to the “CALIBRATION” menu.
10. To activate the new settings, switch the truck off and on again.
11. Carry out a test run.

Control Modules



GPC476

1 Access 3/2
2 FU7 (400 A), power fuse for Access 3/2
3 Access 5
4 FU8 (30 A), power fuse for Access 5

General

Travel functions and power steering are controlled by modules which communicate with each other via a common CAN-Bus:

- Access 1 (Display)
- Access 3 (Traction Control Module)
- Access 5 (Steering Control Module)
- Access 8 and 8.1 (CAN interface #1 and #2)

The module locations are shown in *Components* (see page 50).

Power Fuses

The power fuses (2, 4) are mounted directly on the controllers (see Fig. GPC476).

Servicing and Replacing the Control Modules

WARNING

Short circuits can cause fires!
Control modules operate at high currents. Note the following:

- *You must be trained to carry out this work.*
- *Use non-fatigue eye protection.*
- *Wear close-fitting clothing.*
- *Do not wear jewelry.*
- *Always use insulated tools.*

CAUTION

Incorrect procedures can lead to serious injury!
Avoid accidents by:

- *Switching the truck off*
- *Disconnecting the battery.*
- *Preventing the truck from being switched on again.*
- *Jacking up the truck and preventing it from rolling away (see page 14).*

Discharging the Capacitors

The truck must be de-energised and secured, see safety notices. Once this has been done:

1. Short the positive and negative connections of the control module over a resistor (10 - 100 Ohm, min. 5 W) for a few seconds.

Servicing the Control Modules

The truck must be de-energised and secured, see safety notices.

1. Discharge the capacitors.
2. Dry clean the outside of the control module.
3. Check that the nuts attaching the power cables are tight (for torques see page 19).
4. Check the logged events.

Replacing Control Modules

Removal

The truck must be de-energised and secured, see safety notices. Once this has been done:

1. Discharge the capacitors.
2. Remove / disconnect all wires (mark the wires if necessary). Remove the bus bars if present.
3. Remove the control module mounting screws.
4. Remove the control module.
5. Check the tooth pattern left by the back plate of the control module on the assembly plate. The full surface area of the control module must be in contact with the plate. If there are large areas with no contact to the controller, replace the assembly plate to avoid thermal problems.

NOTE

Note that for control modules with radiator fins (e.g. Access 2/3) item 5 does not apply on removal.

CAUTION

Hazardous chemicals can cause serious injury.
Observe the manufacturer's safety instructions when handling solvents and lubricants.

6. Remove the heat conducting paste remains on the assembly plate with a lint-free cloth and a commercial silicon removing agent.

Assembly

Use a control module with the right software version (see spare parts manual).

NOTE

Note that for control modules with radiator fins (e.g. Access 2/3) item 1 does not apply on assembly. When installing these control modules make sure that they are positioned on the bus bar in such a way that they cannot twist when screwed tightly.

1. Apply heat conducting paste (Dow Corning® 340, part no. 053051-008) thin and evenly to the base plate of the new control module.
2. Attach the control module to the assembly plate.
3. If necessary clean the power cable connections.

4. Refit / connect all wires. Attach the bus bars if applicable (for torques see page 19).
5. Set the control module parameters and carry out a functional test:
   - Leave the truck jacked up.
   - Connect the battery and remove the power-up prevention mechanism.
   - Adjust the parameters (see page 81).
   - Carry out a functional test.

Event Codes - Access 3

Event Code	Tool LED	Operating error LED	Description	Remedy
300	X	-	Controller internal error.	- Replace controller.
301	X	-	Memory error. Parameter changes have been cleared or are no longer stored. The truck can operate, but uses the default settings.	- Re-load the default settings (attention - this resets the default settings of all the controllers). - If the error persists after switching the truck off and on again, replace the controller.
302	X	-	Controller internal error.	- Replace controller.
303	X	-	Controller internal error.	- Check the power cables for corrosion. Make sure they are securely attached. - If the cable attachment is ok, replace the controller.
304	X	-	Overvoltage or low voltage (limits are 45 volts and 9 volts respectively).	**If the event occurs when the truck is powered up:** - Voltage on PC200-4 drops to below 9 volts. Replace controller. **If the error occurs during travel:** - Check battery condition. - Check battery cable connections. - Check main contactor contacts.
305	X	-	Voltage on VMN too low.	**If the event occurs when the truck is powered up:** - Check power cable connections to motor. - Check internal motor connections. - Check motor insulation resistance to chassis. If no error is found on the motor, the controller is faulty. Replace controller. **If the event occurs during travel:** - Check motor connections. - Check main contactor contacts. - Check motor insulation resistance to chassis. If no error is found on the motor or main contactor, the controller is faulty. Replace controller.

Event Code	Tool LED	Operating error LED	Description	Remedy
306	X	-	Voltage on VMN too high.	**If the event occurs when the truck is powered up:** - Check power cable connections to motor. - Check internal motor connections. If no error is found on the motor, the controller is faulty. Replace controller. **If the event occurs when the main contactor is closed:** - Check motor connections. - Check motor insulation resistance to chassis. If no error is found on the motor, the controller is faulty. Replace controller.
307	X	-	Main contactor already closed.	- Check freedom of movement of main contactor contacts. - Test if main contactor power cable has shorted.
308	X	-	Main contactor does not close.	- Check main contactor wiring. - Measure voltage on coil connections: It should be approx. 24 volts measured between the red/white wires and the battery negative terminal. - Check freedom of movement of main contactor contacts.
309	X	-	Controller internal error.	- Switch the truck off and on again. If the error persists, replace the controller.
310	X	-	Controller capacitors do not charge.	- Check whether additional electrical consumers have been connected without Crown's permission. If so, disconnect these consumers and start the truck. If the error persists, replace the controller.
314	X	-	Main contactor driver shorted.	- Check for short circuit or low impedance between CA200-17 and $battery_{negative}$. If there is no error in the wiring, replace the controller.

Event Code	Tool LED	Operating error LED	Description	Remedy
315	X	-	Main contactor driver	- Measure voltage on the main contactor coil connections: It should be approx. 24 volts measured between the red/white wires and the battery negative terminal. - Check main contactor wiring for damage. If the main contactor and its wiring are ok, replace the controller.
316	X	-	Main contactor coil and/or brake coil shorted.	- Check wiring for brake and main contactor. - Disconnect the main contactor and measure the coil resistance: It should be $R_{25\ °C}$=44 Ω. - Disconnect the brake and measure the coil resistance: It should be $R_{25\ °C}$=10 Ω. If no error is discovered in the wiring, the main contactor or the brake, then the controller is faulty. Replace controller.
317	X	-	VACC error	- Check if the traction potentiometer resets itself to 0 volt output voltage in neutral: Service Menu > Analyzer > Acess 3 Inputs > A2.3.5 > POT WPR. - To calibrate the potentiometer: Service Menu > Calibration Menu > C1 > FWD/REV ROCKER
320	X	-	No CAN Bus communication between controller and display.	- Switch off the truck and measure the resistance on connector CA200 between pin 1 and pin 2: It should be R=60 Ω. - Check connector on display. - Check that the display is working correctly.
321	X	-	Truck model not selected.	**Warning:** The setting *cannot* be reversed. - In the service menu display select > Features Menu > F4 > Truck Type TC 3000 and adjust.

Event Code	Tool LED	Operating error LED	Description	Remedy
322	X	-	Short circuit from positive brake connection after battery+.	- Measure voltage from CA200-7 after $battery_{negative}$. If the voltage is 0 V, there is a short circuit between the positive brake connection and PC300-20 on the controller. Remove pin PC300-20 temporarily: If the error still persists, the controller must be faulty. Replace controller.
324	X	-	Controller internal error.	- Replace controller.
325	X	-	Controller internal error.	- Replace controller.
326	X	-	Controller internal error.	- Replace controller.
328	X	-	Controller internal error.	- Replace controller.
329	X	-	Controller internal error.	- Replace controller.
330		-	PPCS error	- Check switch in Analyzer menu: Service Menu > Analyzer Menu > Access 3 Inputs > A2.3.11 - A2.3.14 If the truck is idle: A2.3.11 = A1, A2.3.12 = A3, A2.3.13 = A5, A2.3.14 = A7
332	X	-	Controller internal error.	- Replace controller.
333	X	-	Controller internal error.	- Replace controller.
334	X	-	Controller still in system test phase.	- The event deletes itself after the system test.
337	X	-	Controller internal error.	- Replace controller.
338	X	-	Incorrect battery voltage	- Check the battery voltage: SERVICE MENU > ANALYZER > A3 > OUTPUTS > A3.2 BATTERY VOLTAGE. - Measure the battery voltage directly on the battery terminals. - If the voltages differ, replace the controller.
340	X	-	Unsuitable parameter setting for drive motor.	**Attention**: re-loading the default settings will clear *all* customer-specific settings in *all* the controllers. - To restore the default settings: SERVICE MENU > PERFORMANCE > P20 > LOAD FACTORY DEFAULTS and restart the truck. - If the error still persists, the controller must be faulty. Replace controller.