

1. DESCRIPTION

SATURNE building maintenance units (BMU) are designed for high-rise buildings or buildings with facades difficult to access, covering heights of **200 m or more** with compact sized equipment.

With a cradle for **two people**, SATURNE BMUs ensure fast and safe operation.

Recessed facades can be accessed using articulated cradles.

The installation consists of:

- a **mobile traversing trolley** with one jib and the lifting and control mechanisms
- a **working cradle** suspended from the trolley by four independent galvanised steel wire ropes
- a **concrete track or rails**

All the operations are powered using a MAGTRON remote control unit :

- lifting and lowering the cradle
- inclination of the jib(s)
- traversing the trolley
- slewing of the turret and the spreader bar
- optional telescoping of the jib and/or the vertical mast.

2. THE SATURNE RANGE

2.1 Standard series

Standard machines (series S200 and S300) can have **1 jib** up to 15 meters. The hydraulic on the jibs is used to bring the cradle close to the facade and to lift it over parapets.

This type of machine **provides optimum access to every part of the building, particularly the corners.**

The end of the jib is fitted with a spreader bar which enables the cradle to be rotated to bring it parallel to the building. This type of machine offers a high level of comfort to operators.

Each case will be individually studied by Secalt engineering department in cooperation with the architect to meet the exact requirements:

- length of jib to cover all the glazed areas of the building,
- lifting height to cover the glazed areas,
- height of parapet.

CE The SATURNE machine conforms to EU Directives and is manufactured in accordance with ISO 9001

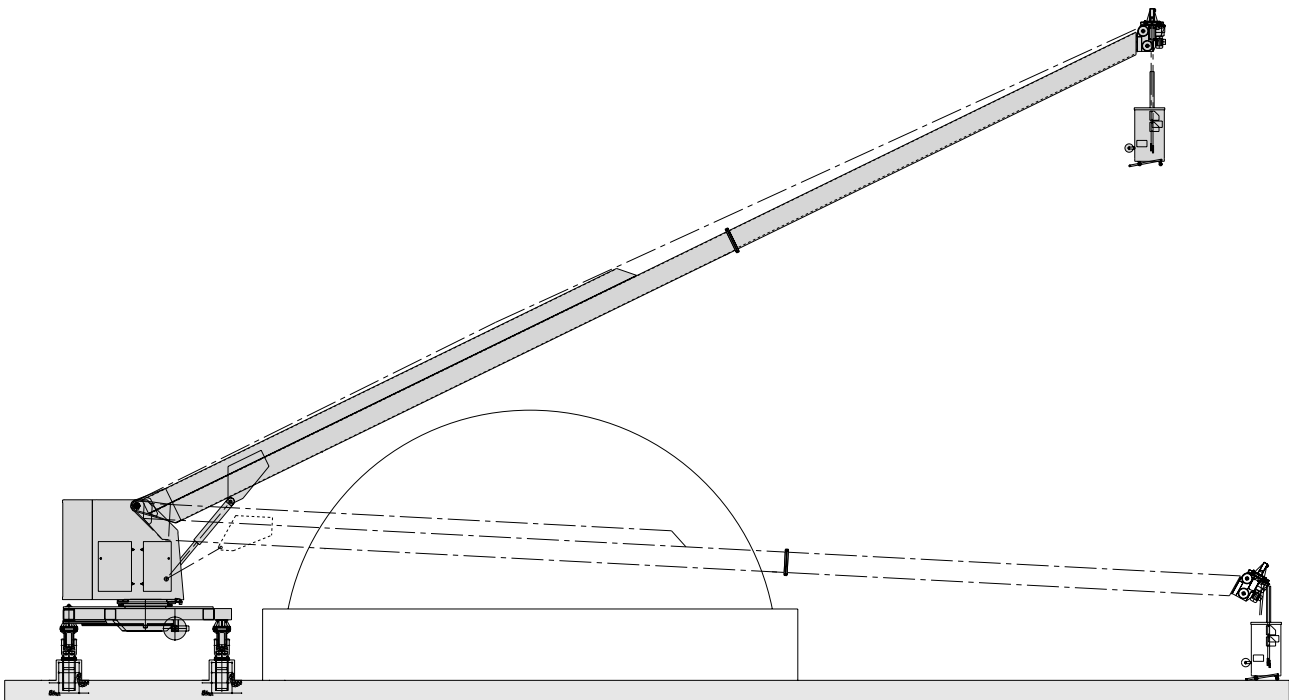
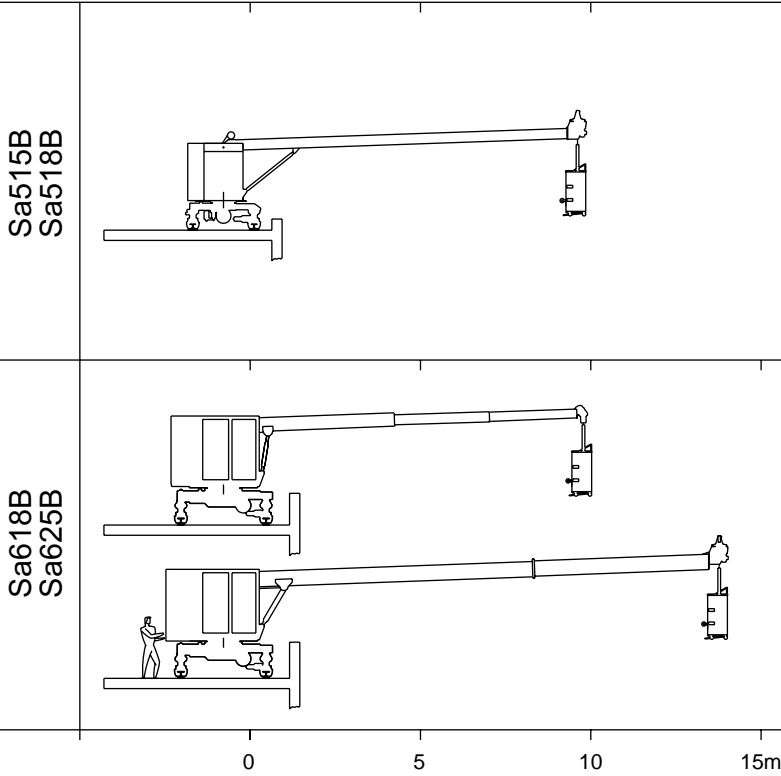


Fig. 1 - AEF SATURNE



models Sa515/Sa518: single jib machines (fix or telescopic jib) with spreader bar and slewing ring. Optional increased jib height. Traversing on concrete track or rails. Jib length and working height* adapted to the configuration of the building.
Weight \pm 10000 kg.

models Sa618/Sa625: single jib machines (fixed or telescopic jib) with spreader bar and slewing ring. Traversing on rails. Jib length and working height* adapted to the configuration of the building.
Weight \pm 18000 kg.

The above drawings show:

- special machines Sa500 and Sa600 with their maximum range achieved to date.
- Max. suspended load : articulated cradle AC3 + working load limit + weight of wire ropes = \pm 900 kg.

* Above a lifting height of 40 meters, anchor plugs attached to the facade or continuous guides are necessary to limit the movement of the cradle caused by the wind. The cradle stops automatically at each anchor plug when being lowered or lifted (for details see technical sheet T-517).

3. IDENTIFICATION OF MACHINES

Sa = SATURNE machine
3 m cradle
for 2 people

Sa

5

15

A

A = concrete track
B = rails

5, 6 = single jib machine,
with or without telescopic jib

15 = fixing distance 1500 mm
18 = fixing distance 1800 mm
25 = fixing distance 2500 mm

4. STANDARD SATURNE MACHINES - SUMMARY TABLE

model		maximum working height m						standard length of jibs m										track		fixing distance mm			
		60	80	100	120	180	240	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	A concr.	B rails	1500	1800
Sa 515A	P	X	X	X	X						X									X		X	
	P	X	X	X	X	X	X	X	X	X										X		X	
	F	X	X	X	X						X									X		X	
	F	X	X	X	X	X	X	X	X	X										X		X	
Sa 515B	P	X	X	X	X							X										X	
	P	X	X	X	X	X	X		X	X	X										X	X	
	F	X	X	X	X									X							X	X	
	F	X	X	X	X	X	X		X	X	X	X									X	X	
Sa 518 B	P	X	X	X	X										X						X		X
	P	X	X	X	X	X	X					X	X								X		X
	F	X	X	X	X											X					X		X
	F	X	X	X	X	X	X						X	X							X		X

model		maximum working height m						standard length of jibs m										track		fixing distance mm				
		60	80	100	120	180	240	5	6	7	8	9	10	11	12	13	14	15	16	A concr.	B rails	1800	2500	
Sa 618B	R	X	X	X	X	X	X			X	X	X	X								X		X	
Sa 618B T1 5/7	R	X	X	X	X	X	X	X	X	X												X		X
Sa 618B T1 6/9	R	X	X	X	X	X	X		X	X	X	X										X		X
Sa 625B T1 8/12	R	X	X	X	X	X	X				X	X	X	X								X		X
Sa 625B T1 9/13	R	X	X	X	X	X	X				X	X	X	X	X							X		X
Sa 625B T1 10/14	R	X	X	X	X	X	X					X	X	X	X	X						X		X
Sa 625B T2 6/12	R	X	X	X	X	X	X		X	X	X	X	X									X		X

F = fixed spreader bar
P = rotating spreader bar with parallelogram system
R = rotating spreader bar

5. MAIN COMPONENTS OF A SPECIAL SATURNE MACHINE Sa515B and Sa625B (see figure 3)

- | | |
|---|-------------------------------------|
| 1. Turret | 15. Hydraulic unit |
| 2. Powered slewing ring | 16. Overload limit device |
| 3. Traversing trolley | 18. Upper limit safety device |
| 4. Jib | 19. FINAL upper limit safety device |
| 5. Powered roller frame | 21. Suspension rope |
| 6. Geared motor with brake | 22. Cradle |
| 7. Rear roller frame (not powered) | 23. Support roller |
| 8. Guide wheel | 24. Anti-collision bar |
| 9. Reeler for power supply cable | 25. Swivel castor |
| 10. Guide for power supply cable | 26. Cradle control box |
| 11. Counterweight | 28. Side beam |
| 12. Hydraulic ram / connecting bar | 28.1 Side beam motor |
| 13. TWIN-TIRAK hoist with double wire rope reel | 28.2 Spreader bar slewing ring |
| 14. Geared slewing motor | 28.3 Spreader bar arm |

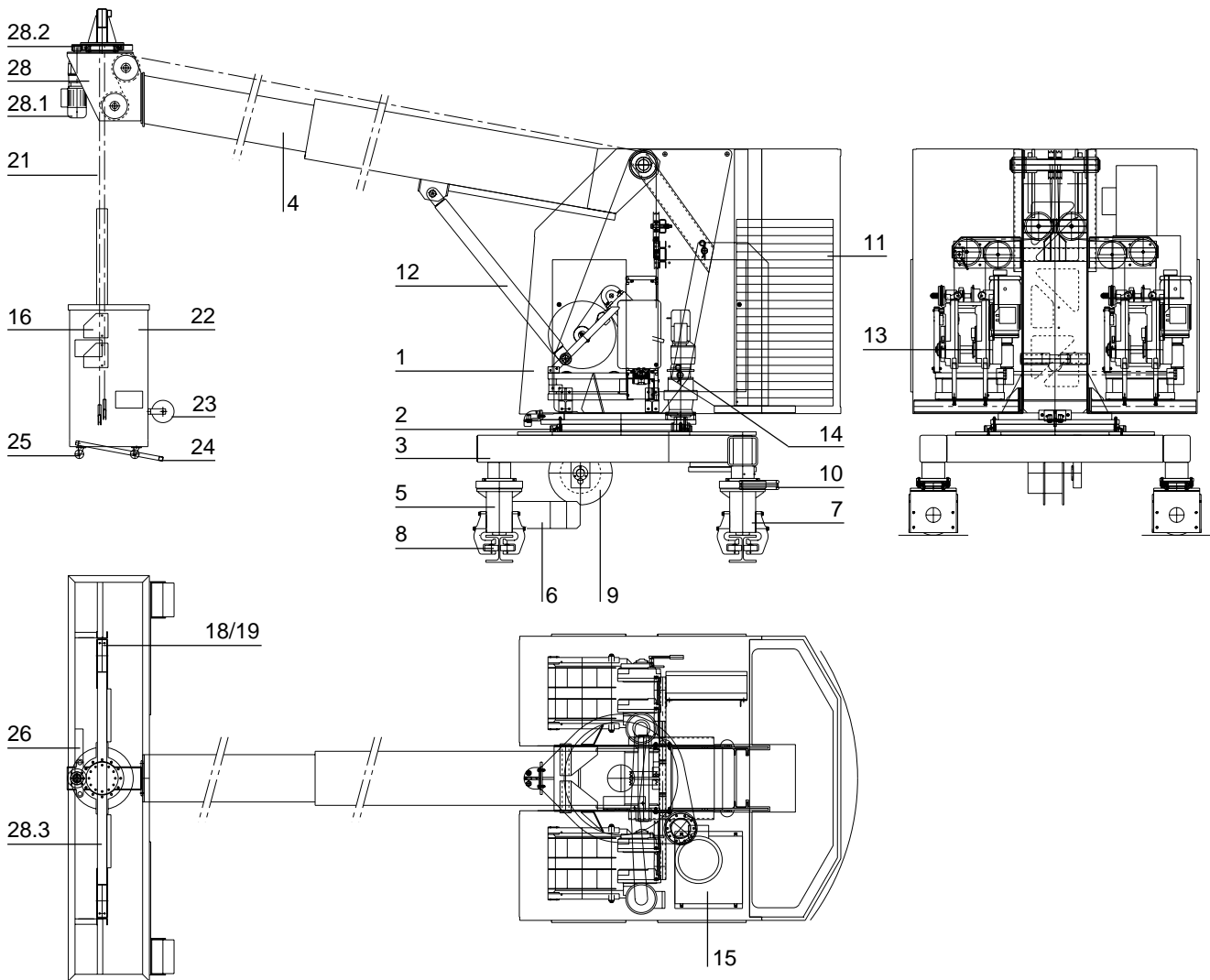


Fig. 3
SATURNE BMU on rails

6. DESCRIPTION OF THE COMPONENTS

6.1. Traversing trolley

The lower trolley (3) is a tubular structure with hot dip galvanised protection.
The trolley (3) and the turret (1) are connected by a powered slewing ring (2).
For a SATURNE running on concrete trackway and with a 1500 mm turret, the rear wheels are mounted on an articulated spreader beam to ensure an even spread of the load on each of the four roller frames.

6.2. Traversing system

Traversing by electrical motor, speed 8 m/min.
The trolley is fitted with 4 wheels with polyurethan tread giving smooth and silent traversing and a good grip.
From the series Sa625 upwards these roller wheels are in steel. In general, only the 2 wheels on the facade are powered.
The trolley is guided along the track by guide wheels (8) placed laterally on the roller frames, whether "L" shaped guide rails (Fig. 4), concrete guides or rails (Fig. 5) are used.

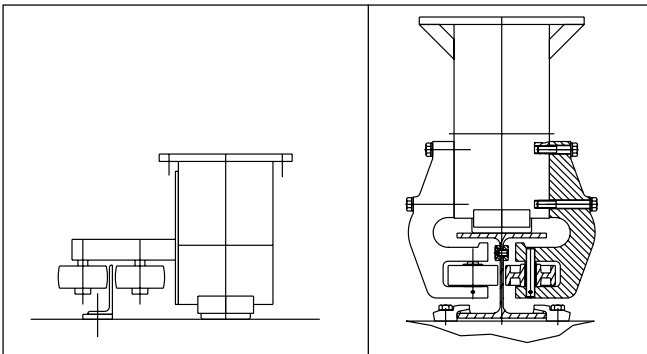


Fig. 4 - Traversing on concrete track. Fig. 5 - Traversing on rails with "L" shaped guide rail

6.3. Lifting mechanism

The lifting mechanism (13) consists of two TWIN-TIRAK model T-1000 hoists, manufactured by the TRACTEL Group and specially designed for SECALT building maintenance units. The wire rope travels in an "S" shaped path around the two adhesion pulleys (Fig. 6). The TWIN-TIRAK hoist is fitted with an overspeed safety brake which operates if the cradle descends too fast, and a disc brake, which is opened electrically as soon as the power is supplied to the motor.

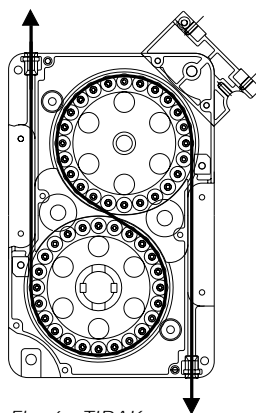


Fig. 6 - TIRAK lifting mechanism

6.4. Hydraulic system

- Depending upon the configuration of the machine, the hydraulic unit supplies :
 - a) the motor for slewing the turret
 - b) a ram which operates the extension/retraction of the telescopic jib or the inclination of the jib
 - c) a ram which operates the extension/retraction of the telescopic mast (see 6.7).

6.5. Jib(s)

- SPECIAL series: The single jib can be fixe or telescopic (1 or 2 telescopic parts).

6.6. Spreader bar

The spreader bar on the special machines is fixed at the head of the jib. It enables the cradle to be rotated by of about 140°.

6.7. Electrical circuit

The electrical circuit consists of the following main items

a) On the building (supplied by the customer)

- the main switch, located on the roof
- power supply points, 3-phase + earth, positioned along the track and protected by a 30 mA differential circuit-breaker

b) On the trolley

- the power supply cable for connecting the trolley to the power points. This cable is stored on a reeler (9) under the trolley.
- an electrical box with a remote control for the trolley

c) On the cradle

- a MAGTRON control box
- an auxiliary control box.

6.8. Cradle

The **standard cradle** (22) is a tubular aluminium structure, clad in perforated aluminium panels.

Length 3 m. Capacity 240 kg max.

The **special articulated cradle** (Fig. 3.1) is suitable for facades recessed up to 3 m with regards to the suspension ropes (model AC3). There is also another, lighter, version for recesses up to 2 m (see technical sheet T-527). Two foam rollers (23) allow the cradle to rest lightly against the facade (max. effort 25 daN) and absorb the swinging movements of the cradle. Four swivel castors (25) fitted to the base of the cradle ease transport on the ground.

An anti-collision bar (24) fitted under the cradle prevents collision with obstacles on lowering.

6.9. Wire ropes

The cradle is suspended from the jib by four steel wire ropes (21), Ø 8.3 mm, type E8 (5x26 + greased PP), minimum guaranteed breaking load 5150 daN. When the wire ropes have passed through the hoist they are wound on powered double reeler (13.1), driven by the output shaft of the hoist, via a chain and pinion system.

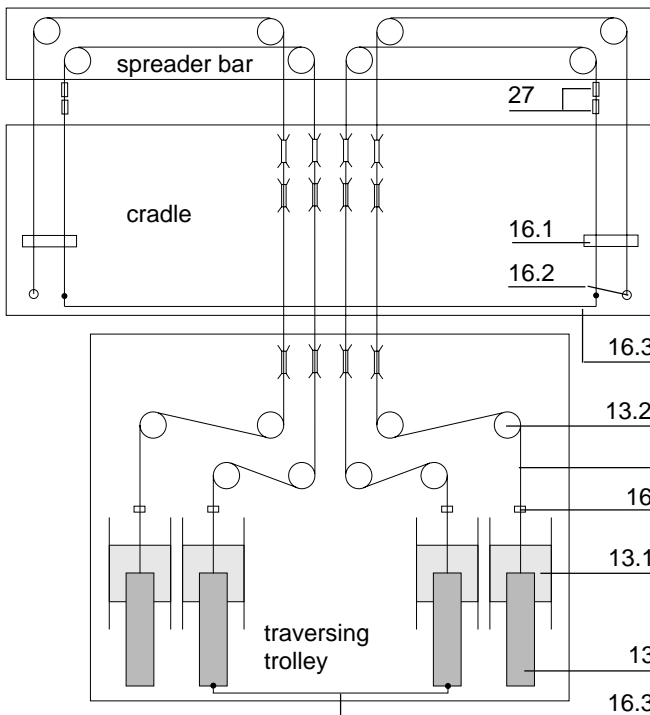


Fig. 7 - Diagrammatic representation of the wire ropes standard machine

- | | |
|----------------------------------|-----------------------------|
| 13 TWIN-TIRAK hoist | 16.1 Overload safety device |
| 13.1 Wire rope reel | 16.2 Insulated attachment |
| 13.2 Return pulley | 16.3 MAGTRON link |
| 16 Slack wire rope safety device | 21. Suspension wire rope |
| | 27. Transducer |

7. ELECTRICAL EQUIPMENT

In order to meet customers' requirements during installation, reduce maintenance costs and improve the efficiency of operators, the design of our electrical equipment uses the most modern techniques :

- programmable logic controller (PLC)
- MAGTRON patented remote control system
- microprocessor card, developed by SECALT for the remote control of the trolley
- display units to assist with control and maintenance.

7.1 Control circuit

The equipment is controlled by a TELEMECANIQUE TSX 37-10 programmable controller (PLC) with commands via :

- 1 trolley remote control panel with a 20-function keypad
 - 1 cradle remote control panel with MAGTRON 4020
- The PLC performs three essential functions:
- a) Control of the various operating sequences
 - b) Handling faults
 - c) Decoding the trolley and cradle control signals.

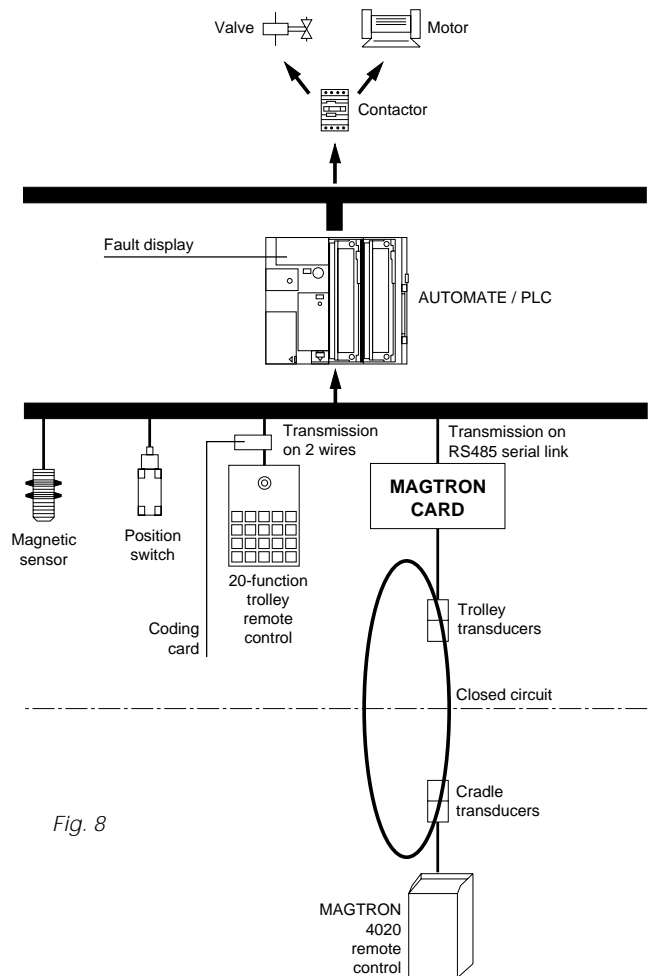


Fig. 8

7.2 MAGTRON remote control

The MAGTRON system is used for duplex transmission of data and telephone signals between the cradle and the trolley, by induction of the magnetic field in a **closed circuit created by the steel carrying wire ropes** (Fig. 8). The signals are transmitted by 4 transducers (1 transmission/1 reception on the cradle and on the trolley).

7.2.1. Advantages of the MAGTRON system

- transmission of commands via the standard metal suspension rope, removing the need for a pendant electrical cable or a special suspension cable with integrated electrical wires;
- MAGTRON does not need a special frequency band;
- as the transmission medium is the metal wire rope and not radio waves, MAGTRON is much less sensitive to interference created by other devices and does not itself cause interference to other systems (electronic or data processing systems, etc);
- MAGTRON control is exclusively for our machines, whereas radio remote control systems are used by many other applications, with the possible risk of there being 2 radios of the same frequency on 2 neighbouring sites;
- control voltage reduced to 10 V, thus preventing any risk of electrocution;
- the telephone and the display to assist with control are provided as standard;
- one MAGTRON model covers our whole range of BMUs;
- the MAGTRON cradle control box is easy to remove in order to protect it from adverse weather conditions and prevent improper use of the machine.

The MAGTRON equipment has been the subject of a safety analysis (APAVE no. 9454079) [French organisation] which guarantees that a system failure will not cause a dangerous situation such as the loss of the emergency stop or the transmission of an incorrect command.

7.3 Telephone and alarm system

7.3.1 Trolley/cradle telephone

The MAGTRON remote control is fitted with a telephone (106) for communication with the trolley telephone, using the principle of alternate transmission.

7.3.2 Control office telephone (option)

Telephone link between the cradle and the building's control office (using the principle of alternate transmission).

7.3.3 Control office alarm (option)

In the event of a fault, an alarm (1 volt-free contact) is sent automatically to the control office or the technical room.

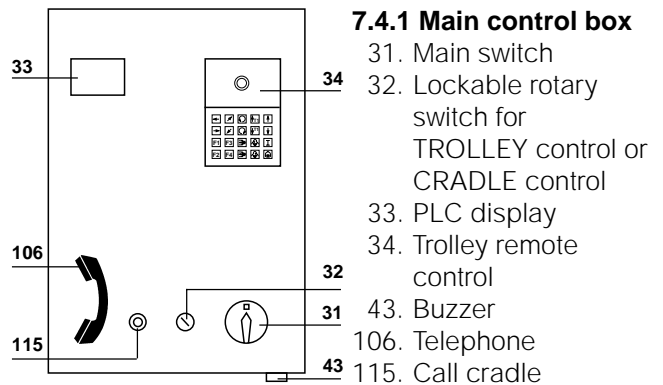
7.4 Controls

The equipment has two control panels :

- 1 main control panel (112) on the cradle (Fig. 11)
- 1 control panel (Fig. 9) on the trolley for switching to work phase and for backup operations in the event of failure of the main panel.

The control panel is selected using the key switch (32) on the main control box.

The electrical enclosure is fitted with a heater to prevent condensation.



7.4.1 Main control box

- 31. Main switch
- 32. Lockable rotary switch for TROLLEY control or CRADLE control
- 33. PLC display
- 34. Trolley remote control
- 43. Buzzer
- 106. Telephone
- 115. Call cradle

Fig. 9 - Main control box and trolley remote control

7.4.2 MAGTRON remote control in the cradle (Fig. 11)

- 113. MAGTRON control keypad (identical commands to those of the trolley remote control)
- 104. Display
- 106. Telephone
- 114. Charger

7.4.3 Cradle auxiliary control box (Fig. 10)

- 42. Emergency stop
- 102. Start/Stop MAGTRON
- 103. Lower anti-collision bar shunt

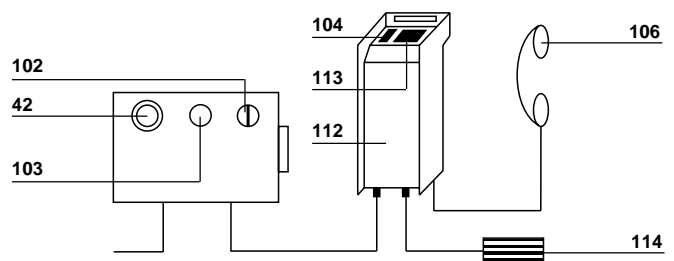


Fig. 10 - Cradle auxiliary control box Fig. 11 - Cradle control box

7.5 Power supply to cradle MAGTRON control box

The cradle assembly is supplied by a Ni/MH (nickel hydride) main battery with a capacity of 9 hours. Recharging takes 3 hours.

A Ni/CD (nickel cadmium) back-up battery which provides one hours operation is brought into operation automatically when the main battery is flat so that the user can take the cradle back up to the roof.

8. SAFETY DEVICES

To ensure safe operation without danger to personnel, the machine is fitted with a number of safety devices which monitor the correct operation of the various components and operate in the event of a breakdown or fault.

8.1. Safety devices on the cradle

- emergency stop
- lower anti-collision bar
- overload safety device
- cradle anti-tilt safety device

8.1.1 Optional safety devices on the cradle

- upper anti-collision bar

8.2 Safety devices on the trolley

- emergency stop
- cradle upper safety limit switch
- cradle FINAL upper safety limit switch
- spreader bar slewing
- slack wire rope safety device
- end of wire rope safety device
- electrical supply cable end limit switch
- traversing end limit switch
- turret slewing
- overspeed
- emergency lowering handle
- phase order safety device
- manual lowering in the event of a power break
- telescopic jib retraction/extension

8.2.1 Optional safety devices on the trolley

- jib lifting safety device
- jib anti-collision device
- anemometer (wind speed indicator)
- detector for presence of rail or concrete guide

8.3 Self-test safety devices

- on the MAGTRON
- on the trolley remote control
- on the contactors

9. FAULT MANAGEMENT

9.1 Display on the PLC

The faults listed below are handled by the TSX 37-10 PLC and shown on the display (33).

The display can also be temporarily assigned to the following maintenance functions :

- display of the state of the PLC I/O
- display of faults on the I/O cards
- display of codes sent by the trolley or cradle remote controls

CODES DEFAUTS - FAULT CODES	
00	Machine prête Machine ready
01	Arrêt d'urgence chariot Trolley emergency stop
02	Arrêt d'urgence plate-forme Platform emergency stop
03	Arrêt d'urgence phonie chariot Trolley phone emergency stop
04	Arrêt d'urgence phonie plate-forme Platform phone emergency stop
05	Défaut test feedback Feedback test faulty
06	Défaut test entrées chariot Trolley inputs test faulty
07	Défaut test entrées plate-forme Platform inputs test faulty
08	Défaut test RS485 / Arrêt d'urgence RS485 / Emergency stop test faulty
09	Fin de course ultime haut Final upper limit switch
10	Survitesse Overspeed
11	Fin de câble End wire rope detector
12	Contrôleur de phases Phase control
13	Défaut contacteurs Power relay faulty
14	Fin de course manivelle Limit switch handle
15	Surcharge Overload
16	Barre anticollision basse Lower anti-collision bar
17	Mou de câble Slack wire rope detector
18	Bimétal TIRAK TIRAK heat sensor
19	Magnétiques moteurs Magnetic motor protection
20	Défaut E/S automate PLC system I/O fault
21	Défaut RS485 RS485 faulty
22	Détecteur de rotation Slewing detector
23	Défaut contrôles télécommande Pendant control card faulty
24	Défaut pile automate PLC battery fault
25	Barre anticollision haute Upper anti-collision bar
26	Anticollision droit sur flèche Jib right anti-collision
27	Anticollision gauche sur flèche Jib left anti-collision
28	Anémomètre Wind speed indicator
29	
30	Demande de start Start required
40	Manque fin de course haut No upper limit switch
41	Manque sélection chariot ou plate-forme No selection of trolley or cradle

! Les défauts 2 et 23 restent mémorisés jusqu'au prochain start.
The faults 2 and 23 are memorised until next start.

9.2 Display in the cradle

This display provides the operator with information on :

- the battery capacity
- the state of the sensors fitted on the cradle
- the control fault codes.