



LED LUMINOUS GUIDANCE SIGN

LIMS

INSTRUCTION MANUAL FOR USE, INSTALLATION AND MAINTENANCE

Compiled by: P. Corinto

Approved by: M. Mazzotti

INDEX

INDEX.....	2
INDEX OF FIGURES.....	3
INDEX OF TABLES.....	3
1 GENERAL.....	4
2 CLASSIFICATION OF SIGNS.....	4
2.1 Type.....	4
2.2 Legend Sizes.....	4
3 MAIN FEATURES.....	5
3.1 Signs Description.....	5
3.1.1 Frame.....	5
3.1.2 Supports.....	6
3.1.3 Panels.....	6
3.1.4 LEDs Luminous Source.....	7
3.1.5 Electronic Board.....	7
3.1.6 Models.....	8
3.1.7 Monitoring Option.....	9
3.2 Part Number Identification.....	10
3.3 Environmental data.....	10
3.4 Electrical Data.....	11
3.5 Luminance Data.....	12
4 INSTALLATION.....	13
5 MAINTENANCE.....	16
5.1 Periodical Checks.....	16
5.2 LEDs Luminous Source Replacement.....	16
5.3 Electronic Equipment Replacement.....	18
5.4 Troubleshooting.....	19
6 DRAWINGS.....	20
6.1 Wiring diagram.....	20
7 LIST OF RECOMMENDED SPARE PARTS.....	21
8 ACCESSORIES.....	21

INDEX OF FIGURES

Figure 1: Exploded view 5
 Figure 2: Frame..... 5
 Figure 3: Support 6
 Figure 4: Panels 6
 Figure 5: LEDs luminous source..... 7
 Figure 6: Electronic board 7
 Figure 7: Overall dimensions..... 8
 Figure 8: Electromechanical relay 9
 Figure 9: Flange Installation with Anchor Bolts 13
 Figure 10: Concrete foundation 15
 Figure 11: Wiring diagram 20

INDEX OF TABLES

Table 1: Types of signs..... 4
 Table 2: Legend Sizes..... 4
 Table 3: Signs dimensions 8
 Table 4: Sign-strip length combination 9
 Table 5: Environmental Data..... 10
 Table 6: Power consumption at maximum luminance 11
 Table 7: Isolating Transformer Size [Watt] without Circuit Stabilizer..... 11
 Table 8: Isolating Transformer Size [Watt] with Circuit Stabilizer 12
 Table 9: Typical Photometric Performance..... 12
 Table 10: Foundation sizes 15

EDITIONS

Ver.	Date	Description	Authors	Reviewers	Approver
1.0	20/01/2017	FIRST ISSUE	P. CORINTO	E. RAULI	M. MAZZOTTI

LIST OF ATTACHMENT

Reference n°	Document Code	Description

ABBREVIATIONS AND TERMS

Term or abbreviation	Description
LED	Light Emitting Diode
ICAO	International Civil Aviation Organization
EASA	European Aviation Safety Agency
PMMA	Polymethylmethacrylate
CCR	Constant Current Regulator
FAA	Federal Aviation Administration

Edition 20/01/2017

LIMS INSTRUCTION MANUAL

1 GENERAL

The internally LEDs illuminated LIMS signs are designed to be used on airport taxiways and runways to convey a mandatory instruction, information on a specific location or destination on a movement area or to provide other information to meet the requirements of Surface Movement Guidance.

LIMS are single face signs in compliance with ICAO - Annex 14 Vol.1, EASA CS-ADR-DSN Chapter N and NATO-STANAG 3316. White on Red, Yellow on Black and Black on Yellow colour combination may be ordered with any desired message.

The signs described in this manual are manufactured to be used on airport series circuits, through isolating transformers, powered by 5-step (2.8 A - 6.6 A), 3-step (4.8 A - 6.6 A), and 1-step (6.6 A) Constant Current Regulators.

Consult ICAO Specs - Annex 14 and ICAO Aerodrome Design Manual - Part 4 for sign features and use.

2 CLASSIFICATION OF SIGNS

2.1 Type

Mandatory signs	White legend on Red background
Location signs	Yellow legend on Black background
Information (direction, destination, boundary) sign	Black legend on Yellow background

Table 1: Types of signs

A sign may consist of multiple arrays of the above messages.

2.2 Legend Sizes

Height of large legend	400 mm
Height of mid legend	300 mm

Table 2: Legend Sizes

3 MAIN FEATURES

3.1 Signs Description

The signs practically include the following sections (Figure 1):

- A. Frame
- B. Supports
- C. Panels
- D. LEDs luminous source
- E. Electronic board

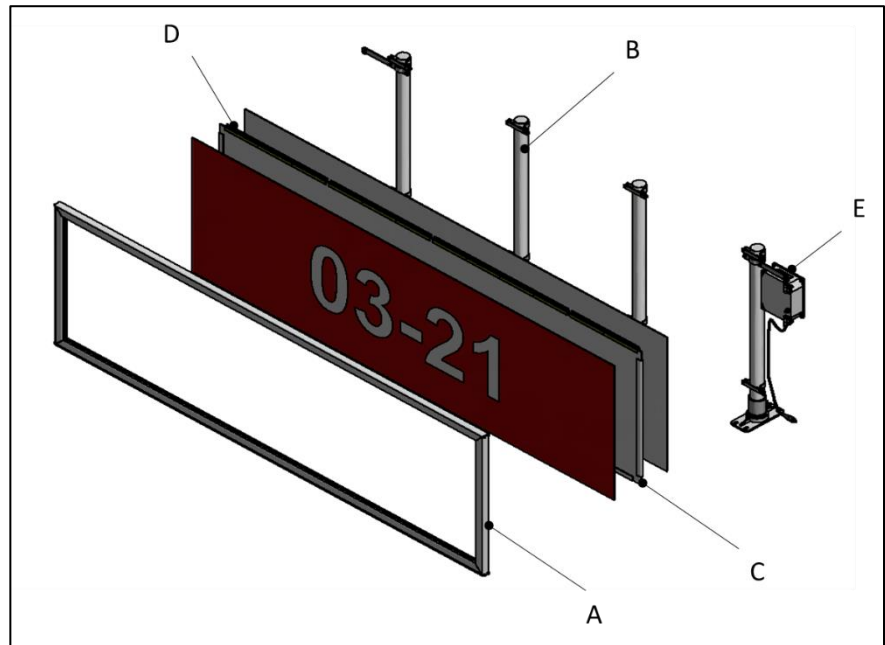


Figure 1: Exploded view

3.1.1 Frame

The frame principally consists of a bearing bottom structure, two sides and one top cover (Figure 2).

Bottom structure, sides and top cover are made of extruded aluminium profiles, realized according to our design.

The signs are equipped with a single top cover, locked to the main structure by means of four hexagonal knob. The main structure is white outside painted (other colours are available on request).

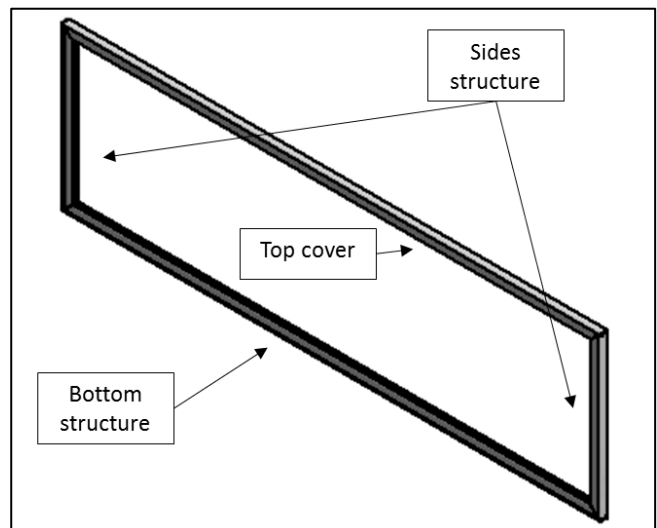


Figure 2: Frame

3.1.2 Supports

Each support includes a pole, a breakable coupling and a floor flange (Figure 3). All components are made of aluminium. The supports are fixed to the structure with "C" clamps.

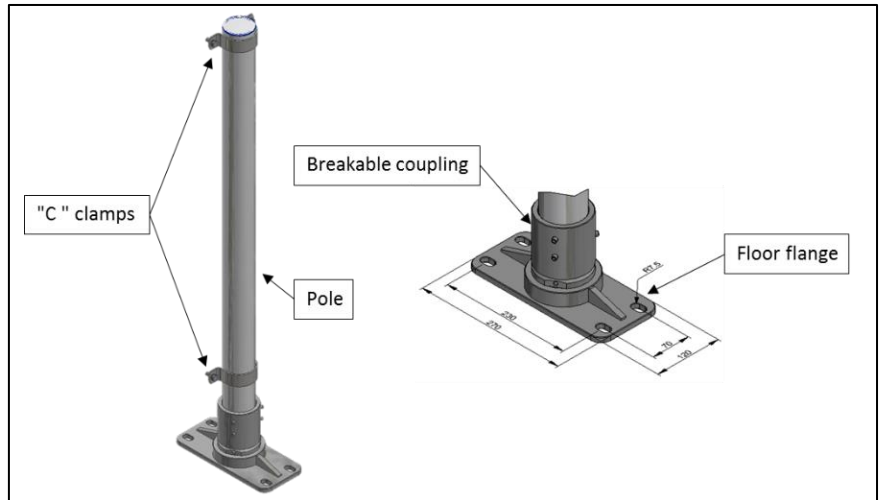


Figure 3: Support

3.1.3 Panels

The panels enclosed in the frame are (Figure 4):

- Text panel
- Light-guide panel
- Back panel

The text panel is made of high performance methacrylate 4 mm thick.

The light-guide panel is made of PMMA, while the back panel is made of a composite material.

The legend is obtained by means of adhesive coloured translucent films applied to the internal side of the text panel.

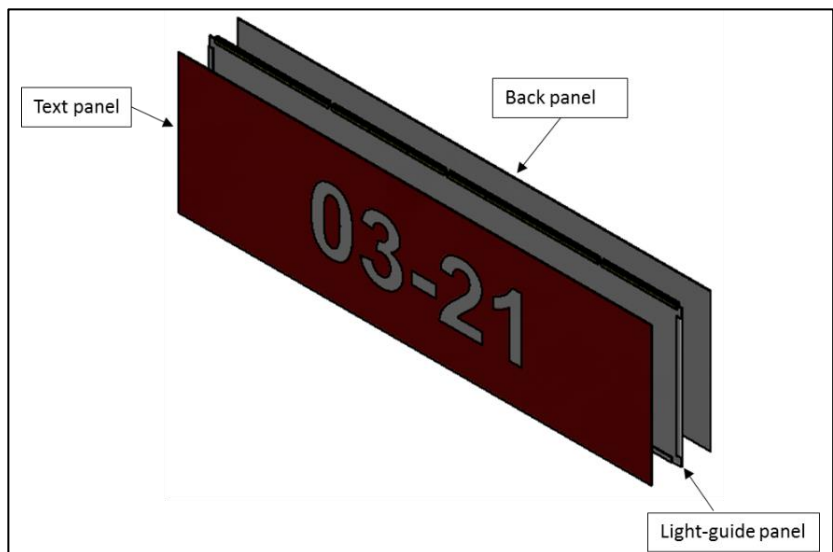


Figure 4: Panels

3.1.4 LEDs Luminous Source

The signs are illuminated by strips LEDs (Figure 5) inserted in suitable supports. High efficiency white LEDs are used, with an average life of 60.000 hours. The positioning of the LEDs has been determined through photometric tests in order to meet the luminance values as required by ICAO Specs - Annex 14. Three different strips lengths are used (720, 960 and 1200 mm) for the different signs lengths (see Table 4).

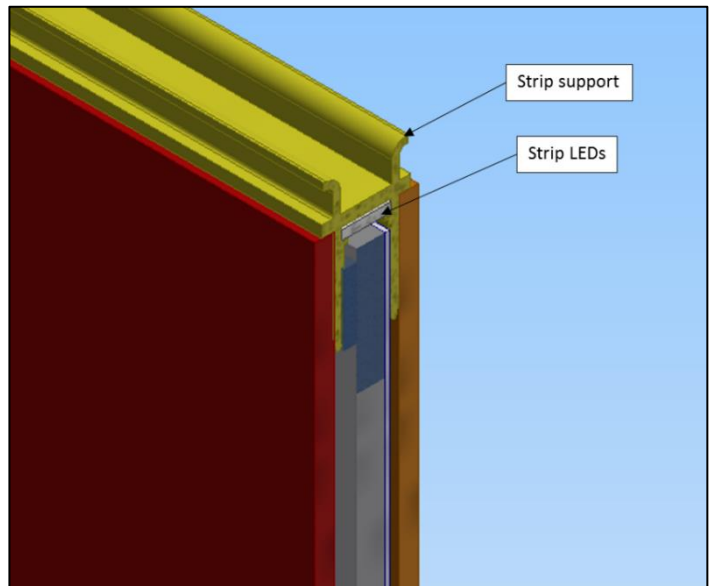


Figure 5: LEDs luminous source

3.1.5 Electronic Board

Signs for series circuits are equipped with a current converter completely assembled on an encapsulated electronic board.

By varying the current of the CCR in the range 2.8 - 6.6A, the power supply board provides:

- a constant current to each luminous source, allowing a constant luminance regardless the step of the CCR (LIMS with single luminance level)
- one out of two possible constant current levels, allowing to change the brightness of the sign based on the step of the CCR (LIMS with two luminance levels)

For the electrical connection to the isolating transformer the sign is equipped with a two-pole cable lead with L-823 plug, style 1.

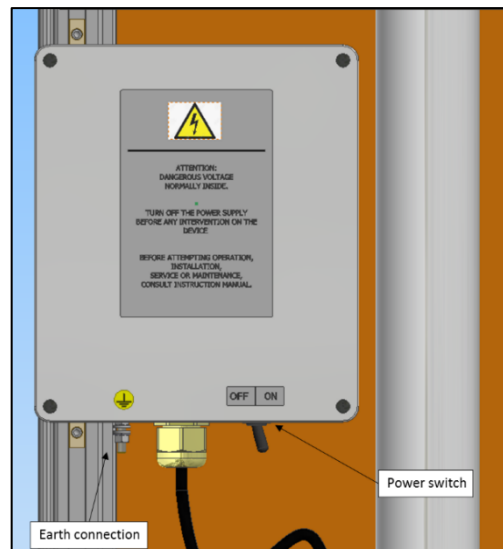


Figure 6: Electronic board



An external power disconnecting ON-OFF switch is provided to break all electrical connections to the sign, in case some signs must be selectively powered off. Note that the power supply from the CCR must be turned off before any intervention on the device.

See from Figure 11 for the wiring diagram.

3.1.6 Models

The main sign dimensions are depicted in Figure 7. The possible values for the lengths A, A', B, C, D and H are indicated in Table 3.

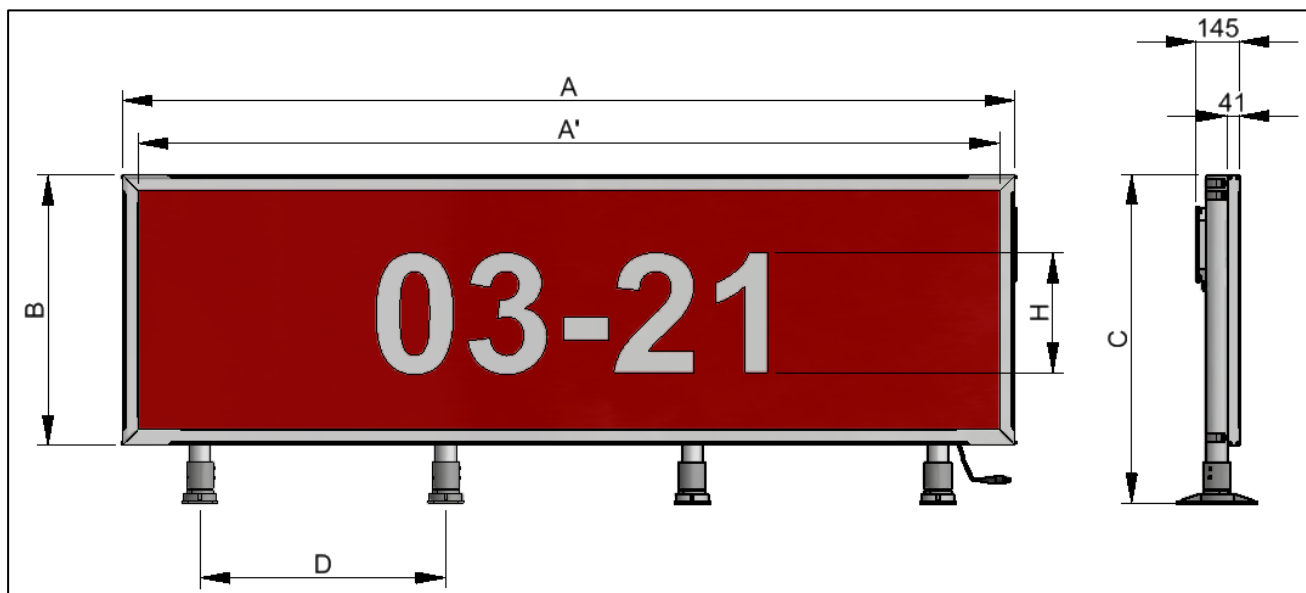


Figure 7: Overall dimensions

Length A [mm]	Visible length A' [mm]	H=300mm B=704mm C=900mm				H=400mm B=904mm C=1100mm			
		Wind @ 320 km/h		Wind @ 480 km/h		Wind @ 320 km/h		Wind @ 480 km/h	
		Quantity	Distance D [mm]	Quantity	Distance D [mm]	Quantity	Distance D [mm]	Quantity	Distance D [mm]
1094	990	2	574	2	574	2	574	2	574
1354	1250	2	834	2	834	2	834	3	417
1574	1470	2	1054	2	1054	2	1040	3	527
2054	1950	3	767	3	767	3	767	4	511
2294	2190	3	887	3	887	3	887	4	591
2534	2430	4	671	4	671	4	671	5	503,5
2994	2890	4	825	4	825	4	825	5	618,5
3744	3640	5	806	5	806	5	806	7	537
3984	3880	5	866	6	693	5	866	7	577

Table 3: Signs dimensions

Three different LED strips are possibly mounted on the signs, according to the overall sign lengths. The correspondence between sign length and LED strip length are showed in Table 4:

Sign length A [mm]	Strip LEDs	
	Quantity	Length [mm]
1094	1	960
1354	1	1200
1574	2	720
2054	2	960
2294	3	720
2534	2	1200
2994	3	960

Table 4: Sign-strip length combination

3.1.7 Monitoring Option

The electronic board of the signs with Monitoring Option has an electromechanical relay with a normally closed contact. This contact is assembled in series with the feeding circuit of the electronic board.

When one or more LED strips fail, the normally closed contact opens, turning off the electronic board and the sign lights off.

A manual intervention is needed to restore the relay contact in closed position and then to permit the sign to switch on again.

Note: If the relay contact is restored after a LED strip failure and no replacement is performed, the monitoring functionality is automatically disabled. The monitoring will not be reactivated by the system until the failed LED strips will be replaced with good strips.

The Figure 8 shows the positions of the relay contact.

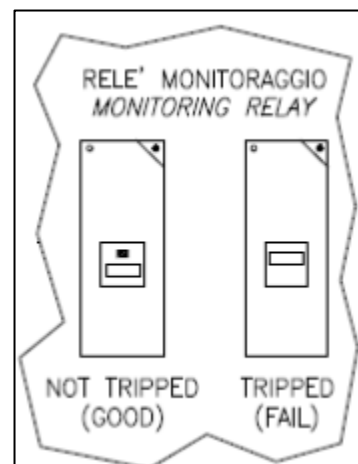
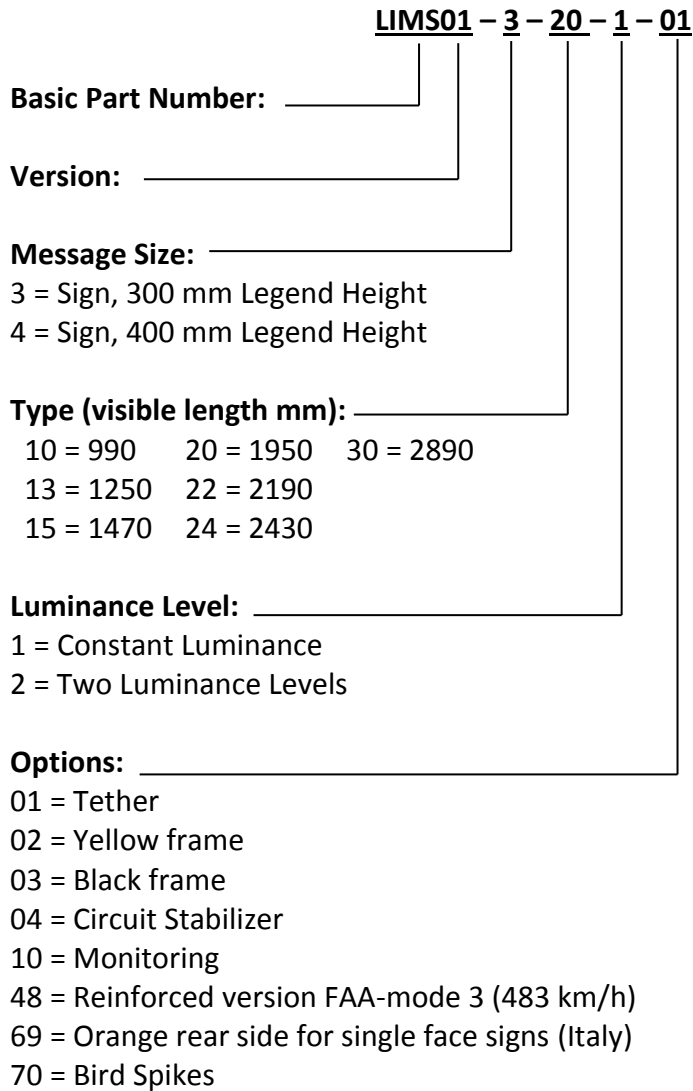


Figure 8: Electromechanical relay

Edition 20/01/2017

LIMS INSTRUCTION MANUAL

3.2 Part Number Identification



3.3 Environmental data

Temperature	-40°C to +55°C
Weather	All outdoor conditions, exposure to: driving rains, snow and icing, salt-laden atmospheres, relative humidity from 5 % to 95 %.
Wind Speed	322 Km/h (standard version) or 483 km/h (reinforced version – OPTION 48) ICAO Aerodrome Design Manual Part 6 Frangibility

Table 5: Environmental Data

3.4 Electrical Data

The luminous signs are powered by series circuits through isolating transformers compliant to FAA Specs FAA L830-L831. The power consumption of the LIMS signs are reported in Table 6: for all sign type the power factor is higher than 0.9.

Type	Power Consumption [W]
10	32
13	36
15	40
20	51
22	53
24	61
30	70

Table 6: Power consumption at maximum luminance

The minimum size of the isolating transformer depends on both the sign type and the selected power supply (i.e. the number of current steps provided by the CCR), according to Table 7 and Table 8.

Type	CCR TYPE	CCR 5 STEP (2.8 A-6.6 A)		CCR 3 STEP (4.8 A-6.6)		CCR 1 STEP (6.6 A)
		Constant Luminance	Two Luminance Levels	Constant Luminance	Two Luminance Levels	Constant Luminance
10	SINUSOIDAL	150	65*	65*	65*	65*
	PHASE CUT	150	100	100	65*	65*
13	SINUSOIDAL	150	100	100	65*	65*
	PHASE CUT	150*	100	100*	100	100
15	SINUSOIDAL	150	100	100	100	65*
	PHASE CUT	200	100*	100*	100	100
20	SINUSOIDAL	200	100	100*	100	100
	PHASE CUT	200*	100*	150	100*	100*
22	SINUSOIDAL	200	100	150	100	100
	PHASE CUT	200*	100*	150	100*	100*
24	SINUSOIDAL	200*	100*	150	100*	100*
	PHASE CUT	300	150	150*	150	150
30	SINUSOIDAL	300	150	150	150	150
	PHASE CUT	300	150	200	150	150

(*) we suggest to select a larger transformer size in case individual monitoring is performed with MCC devices

Table 7: Isolating Transformer Size [Watt] without Circuit Stabilizer

Type	CCR Type	CCR 5 STEP (2.8 A-6.6 A)		CCR 3 STEP (4.8 A-6.6)		CCR 1 STEP (6.6 A)
		Constant Luminance	Two Luminance Levels	Constant Luminance	Two Luminance Levels	Constant Luminance
10	SINUSOIDAL	150	100*	100*	100*	100*
	PHASE CUT	150*	150	150	150	150
13	SINUSOIDAL	150	150	150	150	150
	PHASE CUT	200	150	150	150	150
15	SINUSOIDAL	150*	150	150	150	150
	PHASE CUT	200	150	150	150	150
20	SINUSOIDAL	200	150	150	150	150
	PHASE CUT	300	150*	150*	150*	150*
22	SINUSOIDAL	300	200	200	200	200
	PHASE CUT	300	300	300	300	300
24	SINUSOIDAL	300	200	200	200	200
	PHASE CUT	300	300	300	300	300
30	SINUSOIDAL	300	200*	200*	200*	200*
	PHASE CUT	300	300	300	300	300

(*) we suggest to select a larger transformer size in case individual monitoring is performed with MCC devices

Table 8: Isolating Transformer Size [Watt] with Circuit Stabilizer

3.5 Luminance Data

Two versions of LIMS signs are available, according to the luminance option selected. For the constant luminance sign, the luminance is practically constant for any value of the series circuit current from 2.8A to 6.6A and the relevant values are shown in Table 9. In case of two luminance levels, the high intensity level is selected with a current greater than 6A, while with any values between 2.8A and 6A the low intensity luminance is provided. The high and low luminance levels are reported in Table 9.

	High Intensity Level (and Constant Luminance)		Low Intensity Level	
	ICAO Requirements	Typical Value	ICAO Requirements	Typical Value
Average luminance yellow	>150 cd/m ²	180 cd	>50 cd/m ²	110
Average luminance red	>30 cd/m ²	40 cd	>10 cd/m ²	16
Average luminance white	>300 cd/m ²	350 cd	>100 cd/m ²	135
Maximum ratio between two adjacent points	<1.5	1.3	<1.5	1.3
Maximum ratio across sign	<5.0	1.8	<5.0	1.8

Table 9: Typical Photometric Performance

NOTE: the electrical and luminous data are referred to constant current regulators and isolating transformers manufactured and/or distributed by OCEM. The data may change with constant current regulators and/or transformers manufactured by other Companies.

4 INSTALLATION

- a) Take as reference Figure 7 for spacing between breakable couplings.
- b) Remove the sign from the relevant packing.
- c) The signs are normally installed so that the cable entry is located toward the runway or taxiway edge.
- d) The concrete foundation for the sign should be flat and levelled. Refer to Figure 9 for relevant data. The isolating transformer must be placed inside a concrete pit complete with pipe elbow for the secondary cable passage or inside a steel base complete.
- e) It is recommended that the anchor bolts (M12X60) used for the flange anchoring, are mounted after the completion of the concrete foundation. The anchor bolts have to be walled accurately as shown in Figure 9 and in manner to assure the parallelism of the centreline marked on the flange and the sign centreline.

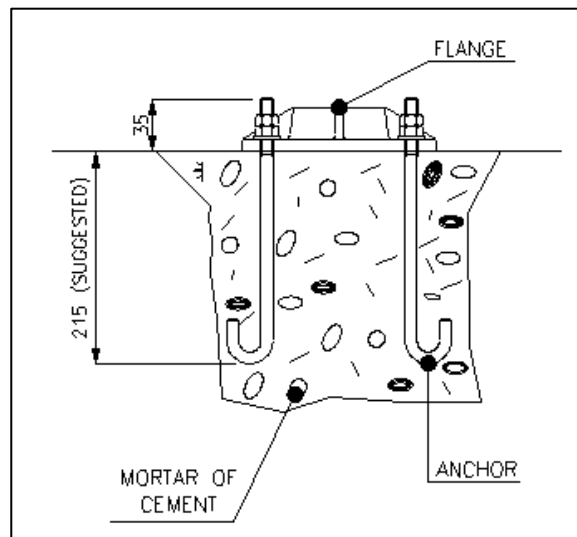


Figure 9: Flange Installation with Anchor Bolts

- f) Remove the frangible couplings/floor flanges from the bottom of the sign by loosening the locking screws (set screw M8x14).
- g) Taking care of the levelling of the floor flanges is very important to ease the installation of the sign. Place a long carpenter level across the top of the breakable couplings to verify their

Edition 20/01/2017

LIMS INSTRUCTION MANUAL

alignment and levelling. Do not tighten the flanges anchor nuts, tight (only finger-tight) until the sign installation is complete.

Lower the sign with the legs onto the frangible couplings and tight the locking screws. Check the sign to be sure that it is levelled. Shim the floor flanges as required and put drying grout under the flange if necessary.

NOTE: some vertical adjustment can be obtained by rotating the frangible couplings a turn or two in the floor flanges.

- h) Once the sign has been levelled, tighten the anchor nuts securely. (NOTE: anchor hardware is not supplied with the sign). Anchor hardware should be corrosion resistant.
- i) Pass the cable lead with plug through the coupling for flexible pipe and connect the cable lead with plug of the sign to the socket of the isolating transformer (be sure that the cable lead with plug be passed through the coupling for flexible pipe). The plug-socket connection should be secured inside the pipe elbow by using the suitable pair of plastic rings or inside the baseplate by using the relevant supporting ring. Screw the coupling to the pipe elbow or to the baseplate, fit the flexible pipe inside it and provide sealing between pipe and coupling.
- j) After the signs have been installed, turn the circuit on to the lowest step and check to see that all the signs are lighted.

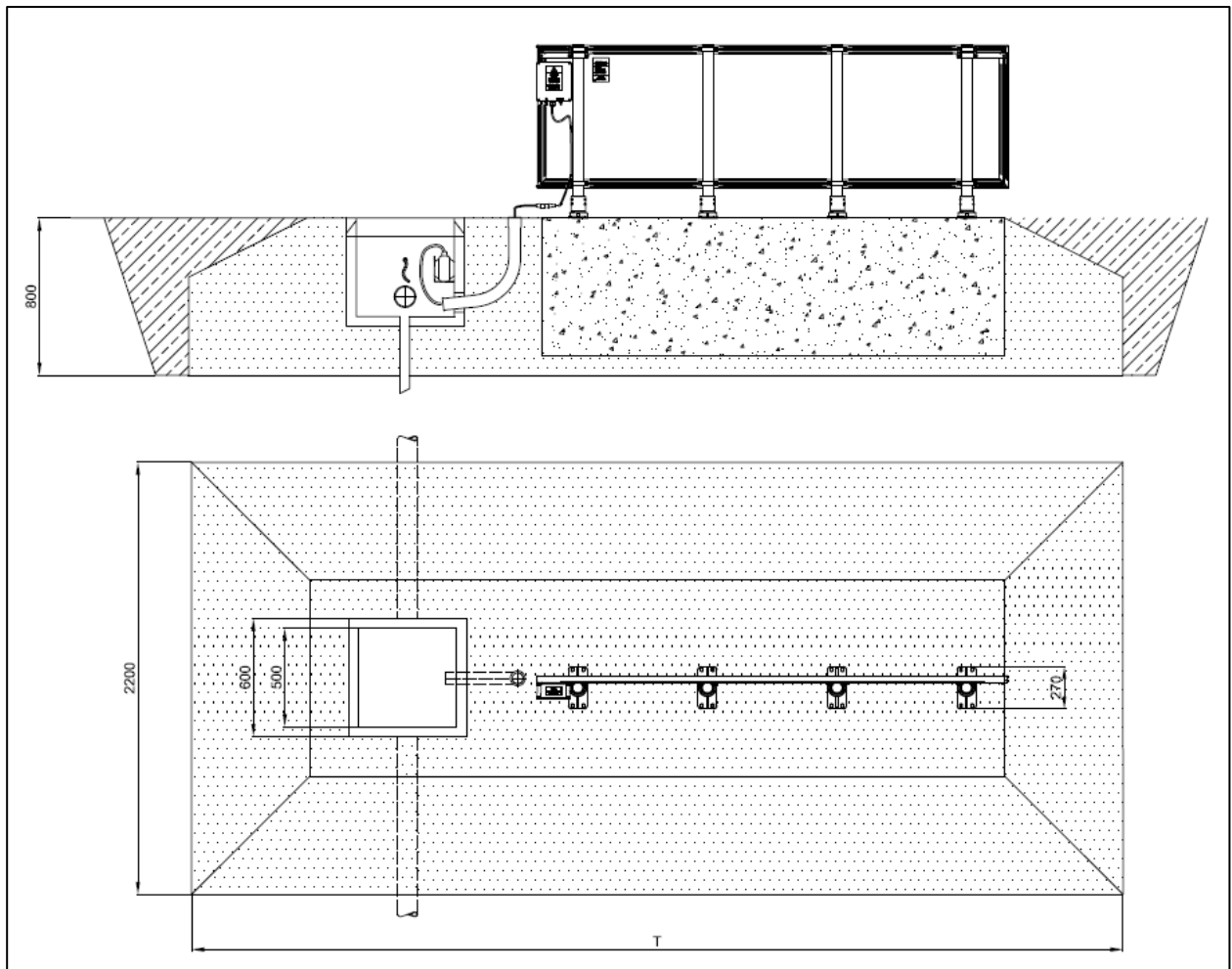



Figure 10: Concrete foundation

Type	T [mm]
10	3469
13	3729
15	3949
20	4429
22	4669
24	4909
30	5369

Table 10: Foundation sizes

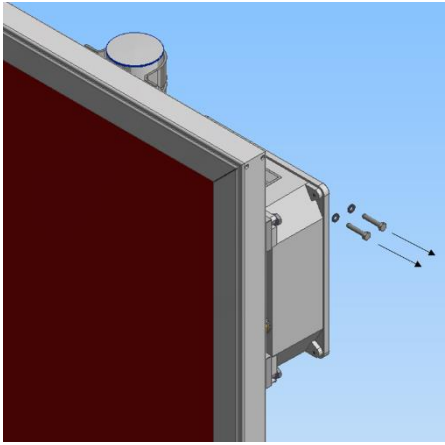
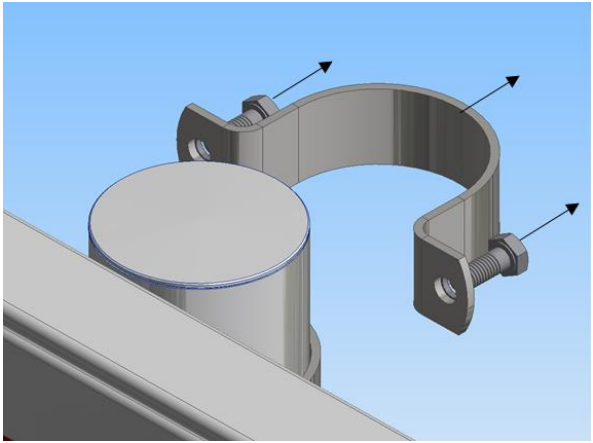
5 MAINTENANCE

	<p><u>ATTENTION!</u></p> <p>Never operate on electrical and electronic equipment while the CCR is ON.</p>
---	---

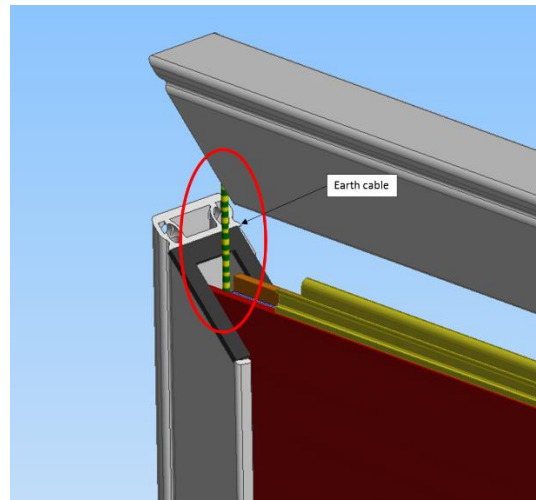
5.1 Periodical Checks

Daily	Check for burned-out led
Monthly	Check for dirty panels
Semi-Annual	Check for loose wire connections
	Check for cracked or deteriorated wires

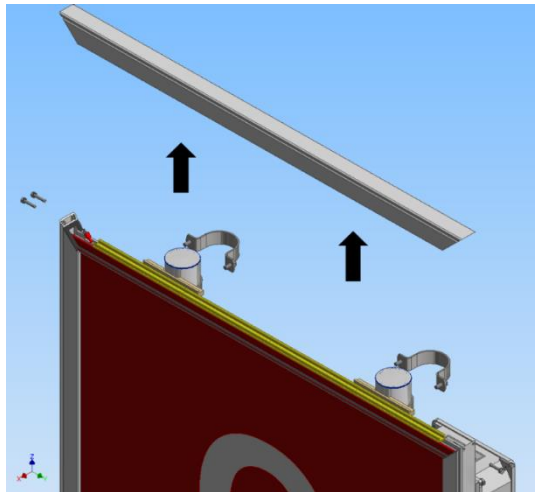
5.2 LEDs Luminous Source Replacement

<p>a) Be sure that the series circuit is de-activated (CCR OFF); in any case turn the main switch to OFF position</p>	
<p>b) remove the four screws that connect the top cover with the sides of the structure</p>	
<p>c) remove the four top "C" clamps of the supports</p>	

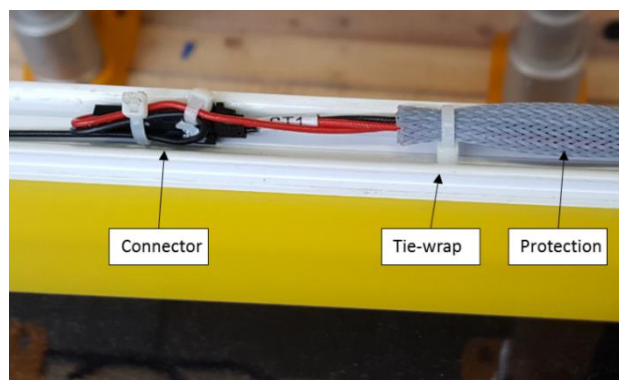
d) lift the top cover carefully of a few centimeters and disconnect the earth cable



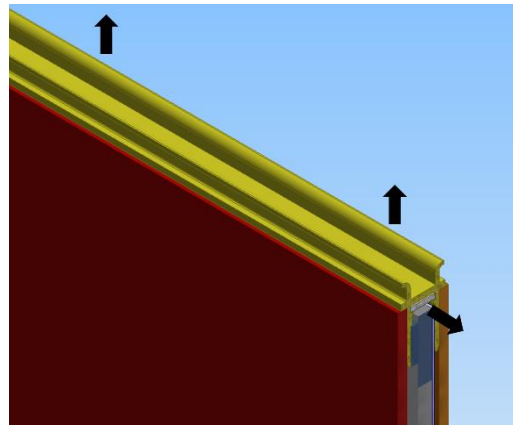
e) remove the top cover



f) cut the tie-wraps and disconnect the connector of the damaged LEDs luminous source



- g) lift the LEDs support and pull the LEDs strip as shown in figure



- h) Restore the initial condition and turn the main switch to ON position, turn On the CCR and check the correct operation of the sign.

NOTE: if the sign has the Monitoring Option, prior to turn the CCR on, you have to restore in GOOD position the contact of the monitoring relay on the electronic board (see par. 3.1.7)

5.3 Electronic Equipment Replacement

If troubles to the electrical/electronic are suspected proceed as follows:

- a) Be sure that the series circuit is de-activated (CCR OFF)
- b) Turn the main switch of the sign in OFF position
- c) Remove the top cover of the electronic box by loosening the relevant four screws
- d) Check the wiring, the connection to the terminal strips and the continuity
- e) If necessary replace the electronic board and then check again the wire connections.
The electronic board has to be replaced for sure if the GDT1 gas discharger is tripped. This could be checked by disconnecting the J1 plug and measure the ohmic resistance between the two pins of the J1 PCB connector: the GDT1 discharger is tripped if the measured resistance is zero or near zero (see Figure 11).
- f) Mount the top cover with reverse procedure
- g) Turn the main switch of the sign to ON position
- h) Turn the CCR on and check the correct operation of the sign.

5.4 Troubleshooting

Problem	Problem cause	Solution
The sign is totally or partially not lighted	Defective LED(s) on luminous source(s)	Replace the LED(s) luminous source(s)
	Defective isolating transformer	Replace isolating transformer
	Defective power supply board	Replace power supply board
	The main switch is left to OFF position	Turn the switch to ON position
	Bad connection	Check wiring

Edition 20/01/2017

LIMS INSTRUCTION MANUAL

6 DRAWINGS

6.1 Wiring diagram

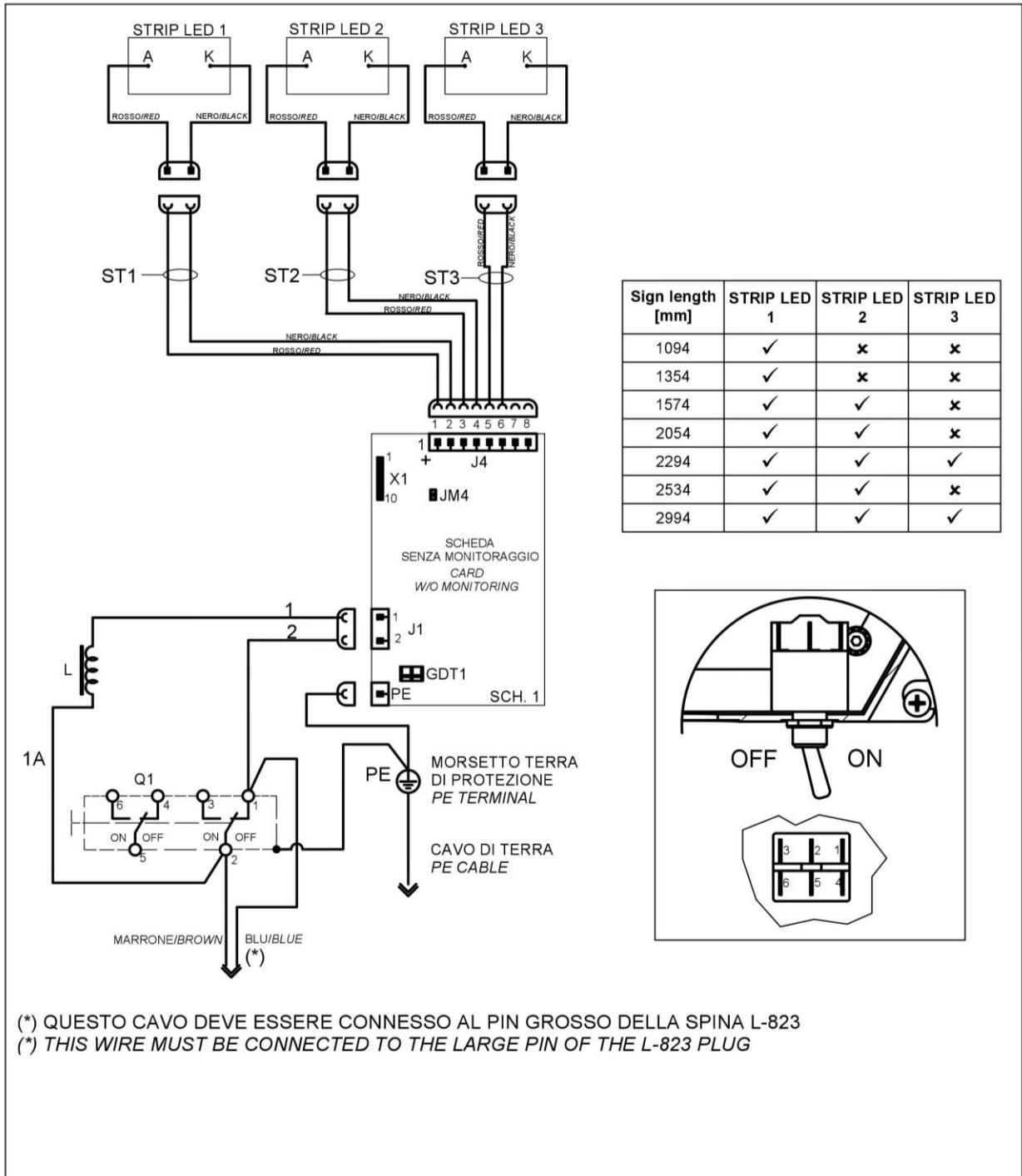


Figure 11: Wiring diagram

7 LIST OF RECOMMENDED SPARE PARTS

Article	Description
150.4382	F323 power supply board w/o monitoring 1 level
150.4383	F323 power supply board w/o monitoring 2 levels
150.4384	F323 power supply board w/ monitoring 1 level
150.4385	F323 power supply board w/ monitoring 2 levels
150.4390	White strip LEDs 720 mm
150.4391	White strip LEDs 960 mm
150.4392	White strip LEDs 1200 mm
GMMMC0005	Breakable coupling for sign with 400 mm legend height and wind @ 322 Km/h
GMMMC0006	Breakable coupling for sign with 300 mm legend height and wind @ 322 Km/h
GMMMC0007	Breakable coupling for sign with 400 mm legend height and wind @ 483 Km/h
GMMMC0008	Breakable coupling for sign with 300 mm legend height and wind @ 483 Km/h
323.2366	Cable Lead 2x2.5 L=2.5m
464.0262	ON-OFF double switch 16A 125V
CMCBG0001	Rubber cap for switch M12x0.75 H20 IP67
GEMMN0008	Inductance 7mH
GEMMN0009	Inductance 3.5mH

8 ACCESSORIES

Article	Description
013.0010	Set of two ryton rings for receptacle support inside pipe elbow
013.0008	Galvanized steel pipe elbow with upper threaded end only
315.3210	Galvanized steel pipe elbow with both threaded ends
315.1228	Base L-867, Class I, Size B, 24" deep
315.1062	Baseplate for L-867 base with gasket and cable clamp
011.3100	Consolidating harness
315.4150	M12x60 anchoring rod, 250 mm long, complete with hardware (4 pieces for each floor flange)