TECHNICAL MEMORY TDMS

INTRODUCTION

Traffic Dianmic Message Sign hereinafter TDMS, has become an indispensable element in the roads, their messages prevent every accident day, congestion, reduce pollution, improve the quality of life of the driver, and even can be said to improve the country's economy.

These obvious benefits are associated with a strategy by the authorities to provide roads intelligent systems that make them safer.

Therefore, the panel is designed as a reliable, robust, valid element and offer added value to the roads.

This document not only exposes as adapted the Traffic Dianmic Message Sign to the new requirements demanded in European Standard EN 12966: 2015 also includes solutions that improve the functional performance of the panel, such as increased resolution, control system pixel in real time to verify the goodness of the message without changing the signaling panel, reduced consumption and improved panel contrast with a new optical display system.

SCOPE

Any TDMS can be adapted to the needs of the road layout and location, likes and / or customer preferences, etc ...

From a TDMS full full matrix color in any possible dimension to a TDMS monocolor only text, which represent letters Alphanumeric established in size and resolution, either in matrix lines with a certain height or totally matrix monocolor area allows adaptation in characters of different sizes and resolutions as needed by the route and / or information to be provided.

Passing the TDMS more standard such as information systems that combine both, with 1 or 2 full color graphics and an area for the monochrome text. This monocolor area can be defined digits allow only alphanumeric characters or be a whole matrix area in which alphanumeric characters can be written either monochrome or graphics.

The resolution of the graphic area and / or alphanumeric is determined by the distance between pixels of the electronic boards, which can adapt to any situation and / or need to display road to the graphic and alphanumeric smaller or larger area.

TECHNICAL DESCRIPTION

The panel will be analyzed from the following aspects:

- optical
    - luminance
    - Contrast Ratio
    - Angle
    - Color
- functional
    - Power Supplies
    - alarms
    - communications
    - Luminance Control
    - LED control
    - Input / Output
    - LED boards
        - Alphanumeric
        - Graphic
- mechanics
    - Case
    - Mechanical strength
    - Degree of protection
    - Durability
    - Safety and electrical insulation
    - Dimensional control

Then we be analyzed each of said points.

Optical performance

Optical performance define the visual quality and readability that will have the TDMS, they are divided into classes. Photometric different parameters and the reference classes listed below:

photometric parameter	Class	Observations
Color	C1, C2	Class C2 is more restrictive
Luminance (La)	L1, L2, L3,	L3 corresponds to the highest luminance
	L1 (T), L2 (T), L3 (T)	These classes are for use in tunnels
Luminance ratio (LR)	R1, R2, R3	R3 corresponds to the highest luminance ratio
Width of the beam	B1, B2, B3, B4, B5, B6, B7	B7 corresponds to the wider beam

CERTIFICADO DE CONSTANCIA DE LAS PRESTACIONES

	Zona gráfica					Zona alfanumérica
	Blanco	Amarillo	Rojo	Verde	Azul	Amarillo
Color	C2	C2	C2	C2	C2	C2
Luminancia	L3	L3	L3	L3	L3	L3
Relación de luminancia	R3	R3	R3	R3	R3	R3
Anchura de haz	B4	B4	B4	B4	B4	B4
Uniformidad	PASA					
Temperatura	T1/T2					
Protección contra ingresos	P2 (IP 55)					
Resistencia a la contaminación	D4					
Corrosión	PASA					
Vibración	PASA					
Resistencia a las cargas horizontales	WL7 DSL4 PL0 TDB1 TDT0					
Resistencia al impacto	PASA					
Parpadeo Visible	PASA					
Sustancias peligrosas	PASA					

PASA; PND = Prestación No Determinada, NA = No Aplica

Luminance

The luminance of the color amber alphanumeric and each color area of the graphic area is **L3.**

The class L3 corresponds to the following minimum and maximum values:

COLOR	LUMINANCE	
	MINIMAL	MAXIMUM
AMBER	7440	37200
RED	3100	15500
GREEN	3720	18600
BLUE	1240	6200
WHITE	12400	62000

Contrast Ratio

The contrast ratio of the color amber alphanumeric and each color area of the graphic area is **R3**.

Class R3 corresponds to the following values for each color:

Red R3 (> 4.2)
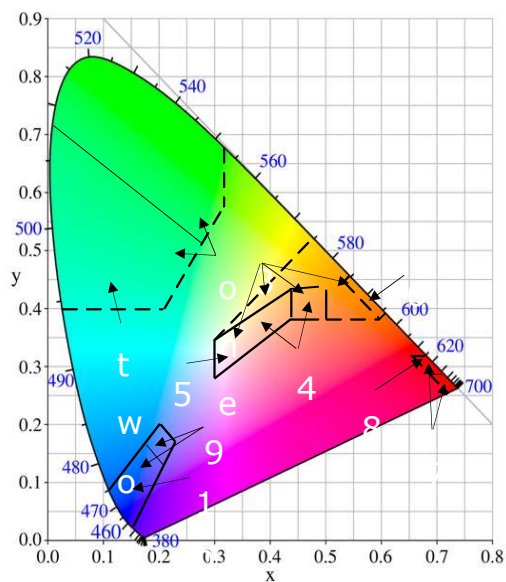
Green R3 (> 1.7)

Blue R3 (> 5)

White R3 (> 16.7)

ÁmbarR3 (> 10)

Angle

The angle of the color amber alphanumeric area and each color of the graphic area is **B4.** This class corresponds to a horizontal angle of 20 ° and a vertical angle of 10°

Color

The amber the alphanumeric area and each color of the graphic area is **C2**.

Key- - -Class C1 and C2 C16 1 green amber C1, C2

− −   Class C1 C1 2 Green Red C27

-                Class C2 3 white / amber C1, C2 C28 red

         4 White Blue C1 C19

         5 white blue C2 C210

FUNCTIONALITY

Controlling

Microprocessors and Embedded Systems

A microprocessor is an implementation as integrated circuit (IC) of the Central Processing Unit (CPU) of a computer. As a result, we often refer to a microprocessor as simply "CPU" and part of a system containing a microprocessor CPU subsystem is called. Microprocessors vary in power consumption, complexity and cost. Subsystem input / output and memory may be combined with a CPU subsystem to form a complete system or embedded computer. These subsystems are interconnected by the system bus (formed in turn by the control bus, the address bus and data bus).
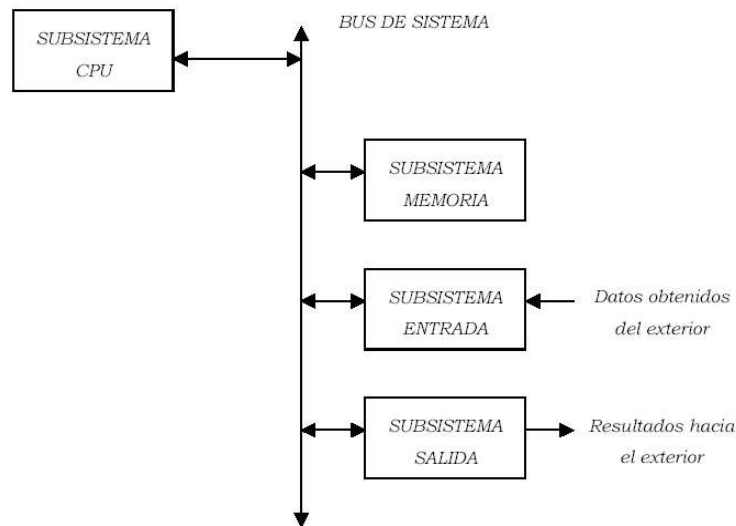

Figura 1.1

The subsystem accepts input data from the outside to be processed while the output subsystem transfers the results to the outside. Most commonly, there are several sub-input and multiple output. These subsystems are routinely recognized as peripheral I / S.

The memory subsystem stores the instructions that control the operation of the system. These instructions comprise the program that runs the system. The memory also stores various types of data: input data not yet been processed, intermediate results and final results processing pending output to the outside.

It is important to realize that the subsystems of Figure structured according to a system functionality. Physical subdivision of a system, in terms of integrated circuits or printed circuit boards (PCBs) can and is usually different. A single IC or PCB can provide multiple functions, such as memory and input / output.

A microcomputer is a complete system implemented with a microprocessor as the main component of the CPU subsystem. It is often integrated into a single chip, along with a limited amount of memory and input / output.

A microcontroller (MCU) is a microcomputer without internal main memory, ie only with microprocessor and input / output. It will have to add memory externally. Among the subsystems E / S including microcontrollers are timers, analog to digital converters (ADC) and digital to analog (DAC) and serial communications channels. These subsystems I / S is usually optimized for specific applications (eg, audio, video, industrial processes, communications, etc.).

It should be noted that the actual lines of distinction between microprocessor, microcontroller and microcomputer in a single chip are diffuse, and are sometimes referred to interchangeably each other.

An embedded system is a microprocessor whose hardware and software are specifically designed and optimized to solve a particular problem efficiently. Usually a continuously embedded system interacts with the environment to monitor or control a process (manufacturing, selling products, appliances or vehicles, etc.). Your hardware is usually designed to level chips, no interconnection of PCBs, seeking the minimum circuitry and smaller size for a particular application.

But, alternatively, can be designed from the level of PCBs buying plates commercial microprocessor that normally respond on other to a standard such as PC-104 (concrete slabs size that are interconnected with each other "stacking" a, each of them with specific functionality within the overall objective that has the embedded system design). The latter solution accelerates design time, but does not optimize nor the size of the system or the number of components used. A simple embedded system will have a microprocessor, memory, peripherals few E / S and a program dedicated to a specific application permanently stored in memory.

The term embedded refers to the fact that the microcomputer is enclosed or mounted within a larger system and its existence as a microcomputer may not be apparent. Non-technical user of an embedded system may not be aware of who is using a system

computer. In some homes the people who do not have to be users of a standard personal computer (PC), use of the order of ten or more embedded systems every day.

Microcomputers embedded in these systems control appliances such as televisions, VCRs, washing machines, alarms, cordless phones, etc. Even a PC has microcomputers embedded in the monitor, printer, and peripherals in general, in addition to the CPU of the PC itself.

A car can have up to a hundred microprocessors and microcontrollers that control things such as ignition, transmission, power steering, antilock brake (ABS), traction control, etc.

Embedded systems are typically characterized by their need for devices Special I / S. When you choose to design the embedded system based on a plate with microcomputer it is also necessary to purchase additional plates or design S E / to meet the requirements of the particular application.

Many embedded systems are real-time systems. A real-time system will respond within a restricted time interval, to external events by running the task associated with each event.

A complex system can use an embedded operating system support for the implementation of its programs, especially when the simultaneous execution thereof is required.

When a most probable operating system used is that you have to deal with a real-time operating system (RTOS), which is an operating system designed and optimized to handle heavy time constraints associated with events in real-time applications. In a complex real-time application using a multitasking RTOS can simplify software development.

Basic architecture

The system controller has a similar architecture to that of a PC. Briefly these are the basics:

- Microprocessor. It is responsible for carrying out major operations calculation of the system. Executes code to perform a task given and directs the operation of the other elements around you, like a conductor of an orchestra.

- Memory. It is stored program code that can run the system and data. Its main feature is that it has read and write access as quickly as possible to avoid losing the microprocessor time on tasks that are not merely calculation. A volatile being the system requires a support where the data is stored even without power or energy.

Today there are in the manufacturers market that integrates a microprocessor and controlling elements of basic input devices and output on the same chip, thinking of the needs of embedded systems (low cost, small size, specific inputs and outputs). Its processing capacity is usually lower than general purpose processors, but fulfill their role as the systems where they are located not require as much power. Leading manufacturers are ST Microelectronics (family of chips STPC), National (Geode family), Motorola (V2 ColdFire family) and Intel.

Power Supplies

The total consumption of classic graphics panel 2 and 3 lines of 12 characters, for example, all pixels lit in white and maximum brightness is 800 W.

In a standard message on a sunny day or cloudy consumption will be in the range of 500W and 700W. If the message is night (less bright) consumption of the Panel will drop to about 60W.

The characteristics of the power supply are:

- Built filter corrector of power factor (0.98)
- With the peak limiter circuit integrated starter
- Remote Control / Remote sensor / power sharing / power signal option
- Burned 100% full load
- Overvoltage / overload / short circuit

Input voltage: 88-264 VAC

Input frequency 47-63 Hz

Current: 7A / 115 V, 3.5A / 230 V

Output voltage: In table below (adjustment ± 10%)

Inrush Current: 12 A / 115 VAC, 25 A / 230 VAC

Overload protection: 105% / 135% Type Cut Current

Overvoltage protection: 115% / 140% of the output voltage

Boot Beak Stable: 1.5 s, 50 ms, 20 ms / 230 VAC

Isolation: I / P-0 / P: 3 KV, I / P-FG: 1.5 KV, one minute

Temperature: 0-45 ° C @ 100 %, -10 ° C @ 80 %, 50 ° C @ 80 % (12 V / V 13.5 0-40 ° C @ 100 %, 50 ° C @ 70 %)

Safety standards: UL 1950, TUV EN 60950

Alarms

The control unit Variable Message Panel is able to perform the following diagnostic on the Panel:

- Real-time control without changing the status of the Panel, goodness pixels, detecting and differentiating pixels or short circuit.

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• Open door	It is activated when any of the doors of the panel is open
• settings changed	It is activated when the TDMS setting has changed. Whether the PBX sends a new configuration to the TDMS, as if for any reason this has been misconfigured. It is deactivated when the control panel reads the configuration of the panel
• Maintenance terminal	It activates the alarm, when connecting the connector maintenance
• internal hardware error	It is activated when the CPU detects that any component is damaged or does not work as expected. This is a severe failure alarm and understood that TDMS can not operate normally. TDMS passes has been 'Off'
• Error in active text structure	It is activated when a literal text of a message presented is not correct. The message is not presented
• Text memory corruption	It is activated when a problem is detected with the memory in which the texts are stored.
• Graphics Memory Corruption	It is activated when a problem is detected with the memory in which are stored graphics
• failure photocell	It is activated when a fault is detected photocell
• Bitmap error	Bipmap shows with LED fault

Communications

RS-232 / RS-422 / RS-485 / Ethernet

GPRS 3G / 4G - Optional.

The panel also has two connectors CANON 9 female pins for communicating this to the outside world, (local mode, remote mode).

One is intended as a maintenance terminal, and the protocol supported by this terminal is RS-232.

When the maintenance terminal is connected you may take complete control of the panel. From that time the panel will answer WACK to an order sent from the control panel. It will return to normal when the operator goes maintenance send order logoff, or in case sending said order forget upon expiry of the inactivity timer (default 15 minutes) then the signals used are described that terminal:

PIN	SIGNAL
2	RX
3	TX
5	GROUND
7	DTR
8	DSR

The other connector is where is linked to the ECL to perform all the functions of communication with the panel, said supports communication protocol RS232, RS422 and provides multipoint communication, inputs and outputs for standard RS422 are optocoupled then signals using said terminal are described:

PIN	SIGNAL
1	TX+
2	RX
3	TX
4	TX−
5	GROUND
6	RX+
7	DTR
8	DSR
9	RX−

The transmission speed for both ports is 9600 baud.

Luminance Control

The TDMS has two light sensors environment, one installed at the top and the other at the back for automatic measurement of the brightness of the panel.

The operator ignores the brightness in 90% of cases.

In the presence of sunlight, the luminance of the TDMS is controlled depending on the sensor receive more light. When the sun is not present regulation is done by the sensor located in the front.

The luminance control, through sensors, can be programmed by the control software to the following states:

Manual programming- without the intervention of the sensors. TDMS has 8 luminance levels according to European standard EN-12966.

Levels depending on external illumination and the maximum permitted luminance at each level:

External lighting (lx)	LEVEL	maximum luminance (cd / m2)				
		Red	Green	blue	Amber	White
40,000	4	15,500	18,600	6,200	37,200	62,000
4000	3	2,750	3,300	1,100	6,600	11,000
400	two	750	900	300	1,800	3,000
40	one	315	375	125	750	1,250
≤ 4	0	95	115	37.5	225	375

The sensitivity of the luminance for amber alphanumeric area and the white area in the graph is 50 cd/m².

LED control

The working current of the LEDs is one of the most important parameters to be controlled to achieve good uniformity and retard aging of these, for this purpose, have proceeded to control the current passing through the LEDs with driver constant current, it allows, regardless of the supply voltage (within the margins of work), the load resistance and the voltage drop of the LED (parameter latter varies) the current flowing through them is constant for all LEDs on the board.

Input / Output

The Panel has 8 digital inputs, 8 digital outputs and 4 analog inputs.

With the I / O Panel allows communication and reception of events occurring in the outside world, such events can be activated pilots, reading supply voltages, light sensors, detection of open doors, etc ... LED Boards

Graph

The graphics card is defined with a resolution of 16x16 pixels, configured latter with 1 red LED, 1 green LED and 1 LED blue each, all SMD technology. The pixel pitch typically is 20 mm, although other resolutions PP25 or PP40 like.

All pixels are equidistantly at a distance of 20 mm on both axes, it allows seamless integration distance, and as seen previously in the optical details, a considerable increase in the contrast ratio.
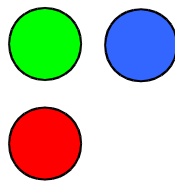
For replacement simply remove anchor nuts 7 with a socket wrench 5.5, having previously removed hoses communications and power.

Had integrable graphic area in the alphanumeric set area, the aforementioned composition RGB an amber LED would be added.
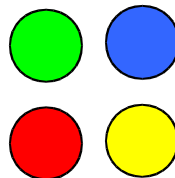
Alphanumeric plate standard is defined to a resolution of 16x11 pixels for a height of 320 mm (although multiple resolutions) configured latter with one amber LED each, all of SMD technology. The pixel pitch is 20 mm.

For replacement simply remove five anchor nuts with a wrench 5.5, having previously removed hoses communications and power.

ANTIALIASING

The antialiasing technique is used for disminuación these small scales that are formed in a straight line or curve when it should be displayed a line or curve completely uniform.

With this technique the annoying "sawing effect or aliasing" occurs in the pictograms because the pixels have a square shape is removed.

Com seen to Figure 1, per correct the "aliasing", is able to control the level of lighting of the pixel individually setting a gray scale for each color, in the figure we can observe, the least 7 color shades Red. The visual feeling you get is that of a border more "smooth" and closer to a uniform curve.

Similarly, if we visualize a signal without color inversion, in low light conditions, the contrast of the signal I is reduced by the amount of white light that envelops the speed parameter (black), see figure 2, if we apply the technology above described color tones can reduicir white level in the contours of the speed parameter getting better visibility in low external lighting.

MECHANICAL PERFORMANCES

Case

TDMS housing constitutes the enclosure in which the different elements, devices and apparatus components are housed panel.

Therefore has the sufficient size for these elements can be easily handled in the normal maintenance operations and also be provided with necessary doors can be made to easily replace components and / or handling.

The casing is the casing that provides protection to the components of the TDMS to atmospheric agents, to the impacts caused by small stones or objects that can be fired by cars and against vandalism.

Therefore, having sufficient strength and provides an adequate degree of protection materials from entering from the outside (seal).

In addition, these characteristics are met throughout the service life of the panel (durability requirement).

Conversely, as the housing is housing different elements and equipment are energized, provides protection for users and service personnel against electric shock, providing adequate measures privacy and security.

The side portions of the casing are smooth and do not protrude so that hinges, etc. Furthermore, the surface finish is such that a risk to users due to reflection or diffusion of light. The front of the housing has a system which prevents direct incidence of sunlight on the window, in order to prevent reflections.

Access doors

The housing incorporated to allow access to its interior, one or more doors, situated at the rear. These doors cover, at least, all the useful surface of the housing (number of lines of characters and / or graphic area), so as to provide easy access to all components.

Doors include a closure system ensuring inviolability. This system incorporates a minimum number of locking points, so that the free distance between them does not exceed 1 m, and include a particular unique tool for the entire panel, said system allowing block, preventing actuation.

Also, these doors incorporate a restraint system or fixing the set and prevents accidental closing when they open. The retention system incorporates a locking system that is operated, manually, when the full opening of the door is made.

The fastening system of retention allows unlocking without using tools.

To ensure protection against possible shocks or shock, the doors have a connection system that ensures the electrical connection around the perimeter of which and the housing.

Mechanical strength

The housing is constructed of suitable materials for use in structural elements and is dimensionally stable and torsionally rigid (the latter is checked both isolated and in conjunction with the support members).

The housing has sufficient rigidity elements in its structure in order to prevent warpage and deformation during transport, installation and subsequent handling, so that once installed the dimensional tolerances are not exceeded in section 3.3.7.

The calculation of the structural strength of the housing and the design of it is made in accordance with the requirements of the UNE 135311: 1998 "Vertical signs. Supporting and anchoring elements. Calculation assumptions ".

Specifically, they consider the actions constant own weight of the housing, corresponding to the weight of the apparatus and equipment permanent loads placed inside and eventually imposed loads.

It also takes into account the dynamic pressure of the wind, the stresses caused by temperature variations and snow overload.

Once all actions considered calculation, it is found especially not permitted maximum deflections exceeded in the UNE 135311 standard as a result of transport and assembly, nor in service.

On the other hand, with respect to the support elements and anchor (frames and banners) on which the TDMS is installed, it is taken into account for the purposes of calculating surcharges, which are visitable.

The housing assembly with the support is adjustable on the horizontal axis a minimum of -6 ° to the normal to the road, so as to ensure that vision signal during at the least 200 m, and can be oriented as in the vertical axis.

Degree of protection

All equipment is installed and working to the outdoors can be subjected to the action of water on their outer surfaces, either by rain and wind or spray from the wheels of vehicles. Therefore, the housing provides protection against dust and water, which is a level IP55, according to UNE 20324 3R "Degrees of protection provided by enclosures".

For verification, a test module is subjected to the test described in UNE 20324 3R standard with levels of severity of 5 (dust protection) for the first characteristic figure and 5 (antisurge water) for second characteristic numeral. The windows and doors are equipped with a perimeter seal of suitable material to ensure tightness.

Durability

The metallic elements of the housing of the TDMS are made of or lined with materials resistant to corrosion.

Its durability is evaluated according to the UNE 112017 "Metal Coatings standard. Corrosion tests in artificial atmospheres. Salt spray tests. "

Moreover, given below a number of general requirements are considered in the design and manufacture of the housing, in order to avoid corrosion problems and ensure the structural integrity of the design:

- using discontinuous welding seams is avoided in the structural elements of the housing. Throat thickness (thickness of the weld bead) is in no case less than 1.25 times the thickness of the base material to be joined. As a measure of the defects possible that could detect welding, some qualities be required, according to DIN 8563 Part 3 of the "CS" type butt welds and the "BK" type joints to overlap.

-   It is important that the cutting, folding and drilling run with appropriate means. The cutting is effected by shear in the case of sheet or splitter in the case of profiles. The sheet bending is performed by mechanical bending. Drilling or punching is effected by mechanical means, it is expressly prohibited the use of thermal means.

-   In the case of painting as a means of protection is used against corrosion is controlled appearance, thickness and adhesion to equipment. The appearance is homogeneous, no sags or unpainted areas. The thickness and adhesion of the paint layer is tested according to UNE, DIN or ASTM. The minimum layer thickness is recommended by the supplier of the paint. The total thickness of the coating is the sum of the minimum recommended by most layer 30 .mu.m. The adhesion is required 3B or higher degree of ASTM D 3359 (method B) norm.

Safety and electrical insulation

The provides housing, both maintenance personnel and other potential users, an adequate degree of protection against electric shock, according to the provisions of the UNE 20550 ("Classification of electrical and electronic equipment as regards protection against electric shock ") for Class I devices.

The chassis of the various devices are interconnected, so that good continuity is ensured. They are considered valid welded joints, riveted, bolted or under pressure.

The electrical equipment is installed and distributed in such a way within the housing that allows maintenance personnel perform manipulations in the right way without any risk.

Regional has a connection point grounding for each mobile or fixed part, according to the UNE 20460-5-54 standard ("Electrical installations in buildings. Choosing and installing electrical equipment. Grounding and protective conductors ").

Masts and the like have their own ground wire, which has a section at the least 10 mm2. The junction of this additional ground conductor is located on the mast itself

above the level of the ground. All this is not necessary if the power is the type of low voltage electrical insulation guaranteed minimum, as defined in the UNE 20460-4-41.

The housings of the panels, doors, bolted connections, locks and hinges metal corrosion protection is considered appropriate conductive ground if its resistance is no greater than 0.2 Ω.

Dimensional control

The dimensional control of the panel assembly admissible dimensional tolerances set then so that no problems arise in installing the panels on the fasteners:

Length up to 2440 mm: ± 5 mm

2440 mm lengths to higher and lower or equal to 4750 mm: ± 8 mm,

4750 mm lengths to higher and lower or equal to 7620 mm ± 12 mm,

Lengths over 7620 mm: ± 15 mm.

The inspection will always proven to anchorages relative dimensions and restraint systems.

Front windows

The front of the variable message panel is designed so that it is not restricted visibility of the message and prescribed luminance levels are achieved in the European Standard EN 12966: 2015 "Variable Message Signs".

The panel has a transparent front screen, and is manufactured so that its connection to the housing structure levels prescribed ensure sealing 3.3.4 and, if possible, that can be easily removed for maintenance.

The front screen carries a transparent anti-reflective treatment.

The material they are made are front screens resists ultraviolet radiation, in order to have adequate durability. Verification of this feature, when using plastics, is effected by the test described in ISO 4892-2 ("Plastics. Methods exposure laboratory light sources. Part 2: Xenon Arc Sources "), method A, with the following levels of severity:

- Irradiation: 550 W / m2

- the black body temperature: 65 ± 3 ºC

- Relative humidity: (65 ± 5)%

- spraying cycle: - duration of spraying: 18 min,

- dry interval between periods spray: 102 min.

On the other hand, the front display resists the tensions caused by the impact of small stones and scratches. This is checked by subjecting a test module to the impact test described in section 4.13.3 of the UNE EN 60598-1 "Luminarias. General rules and general information on the tests ".

In this impact test, the test module will be subjected to three single impacts on the front display points that assume are probably weaker.

The impacts are done by dropping a steel ball of 50 mm diameter and 0.51 kg weight from a height h of 1.3 m, so that energy occurs shock of 6.5 Nm.

In addition, the test module is cooled to -5°C (±2ºC) and maintained at this temperature for 3 hours. While the test module is at this temperature it should be subjected to impact tests specified above.

Test sequence

Electrical tests

Impact

Vibration

Corrosion

Degree of protection

Temperature

Cold

Dry heat or solar radiation

Moist heat

Temperature change

Electromagnetic compatibility

Optical performance

Readability Panel

For example, to a character height 320 mm, the distance is about 200 m readability

Panel weight

The weight of the panel depends on its electron configuration.

Mounting

If necessary, the panel will adapt to the mechanical gantry or existing flag, so the installation will take place in one step.