Flap Displays

1. Introduction

In Solari Information Display Systems, the flap unit is still a dominant component for the visualization of information. Solari flap units are modular and allow for several character heights and widths.

A flap unit consists of a stepper motor, which drives a flap drum and a control system with integrated electronic sensors based on the Hall effect (without sliding contacts). If required, all mechanical parts can be treated with tropicalization processes for installation of the display systems in hostile environmental conditions. Flaps can be plastic-based (PVC or thermo resistant material) or aluminium-based, according to the environment conditions and incident sunlight.

The most important characteristic of split flap displays is that the script is presented as **continuous stroke printing**. This provides up to double the active area of displayed information for the human eye compared with any system of dot matrix.

This feature means that viewing angle of up to 60° is possible without significant loss of legibility and there is no long or short-range loss of legibility due to blurring or discontinuities.

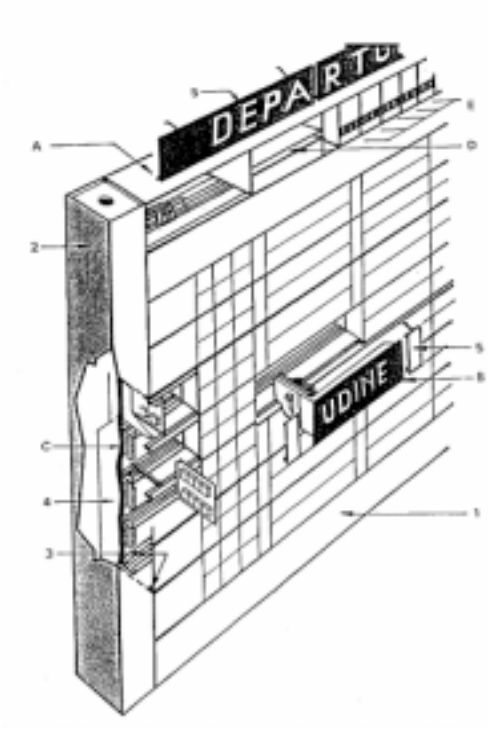
2. Board Structure

Each board is composed of the following standard parts:

- a mechanical structure able to contain the modules, together with the electromechanical and electronic elements needed for their operation;
- a certain number of display units assigned to information display;
- an electromechanical group of elements and electronic elements (controllers, Power supplies, etc.) to control the operation of the display.

The signboard is handled by a main controller (SBC 3200). This device is used as an interface for the standard board controller related to the specific technology.

The physical structure of the display units is composed as follows:



A modular metal support structure, which is normally composed of the following elements:

- ✓ A metal frame able to bear the weight of the board and to stiffen the board's structure and eventually fix it in the installation position (if necessary).
- ✓ A set of extrusions placed one over the other at appropriate distances using spacers (this structure separates the display units which form the various row of the board), if the board is built-up with independent information lines.
- ✓ A metal frame on which the modules are fixed side by side in order to build up a continuous flat active area, if the board must be a graphic type.
- ✓ One or more covering plates are fixed to form the back of the board.
- ✓ Information units.
- ✓ Ribbon cables between the units, power supply and controllers.
- ✓ Printed circuit cards inserted in the header row (main controller) and in the unit row (row controller).
- ✓ Power Supplies

Note: The header row is normally the first row of the board containing the board's control and power supply components. The following fixed inscriptions are silk

screened on the board's covering plates: type of boards, meaning of the information, etc.

The protection of the board from dangers due to short circuits is achieved by means of fuses in the power supplies on the AC input and DC outputs and electronic regulators in the electronic cards. The power supplies are provided with filters on the main input as protection from damage due to electrical interference.

The power input parts of the electronic cards are protected from overloads.

3. Flap Units

Flap units are available in three families:

- ✓ **ECF 35**: 35-mm character height, 40 or 60 flaps per unit
- ✓ **ECF 60**: 60-mm character height, 40, 60 or 80 flaps per unit
- ✓ **ECF 100**: 100-mm character height, 40, 60 or 80 flaps per unit

Within each family, several units are available according to the width of the flap (**module**). Higher values of the module are associated with wider flaps with the capability to display several characters.

The absence of any mechanical contacts guarantees a high reliability. None of the mechanical parts needs lubrication and no preventive maintenance is required except for periodic cleaning of the flaps, according to environmental conditions.

The characters are silk-screened on the flaps using flat, vinyl, antireflective and water-repellent paints.

		mod. 1	mod. 2	mod. 2,5	mod. 4	mod. 5	mod. 6	mod. 8	Flaps
Type 35	L mm	27	62	79.5	132	167	202	272	
X = 35 mm	*	320	400	430	500	560	600	660	40
Y = 68 mm	Weigh	340	420	450	520	580	630	730	60
	t gr.	-	-	-	-	-	-	-	80
Type 60	L mm	46	106	136	226	286	346	466	
X = 60 mm	*	520	960	1040	1320	1490	1540	1950	40
Y = 117.5 mm	Weigh	540	1020	1100	1430	1610	1680	2150	60
	t gr.	-	1080	-	1540	-	-	2350	80
Type 100	L mm	72	172	222	372	472	572	772	
X = 100 mm	*	650	1380	1480	2500	2770	3300	3780	40
Y = 155 mm	Weigh	730	1500	1610	2750	3070	3800	4270	60
	t gr.	-	1620	-	3000	-	-	4760	80

The colour and style of characters may be of any type (Gill Sans Bold, Helvetica, etc.). It is possible to write on half-flaps in reduced size, thereby increasing the letter capacity but decreasing the reading distance.

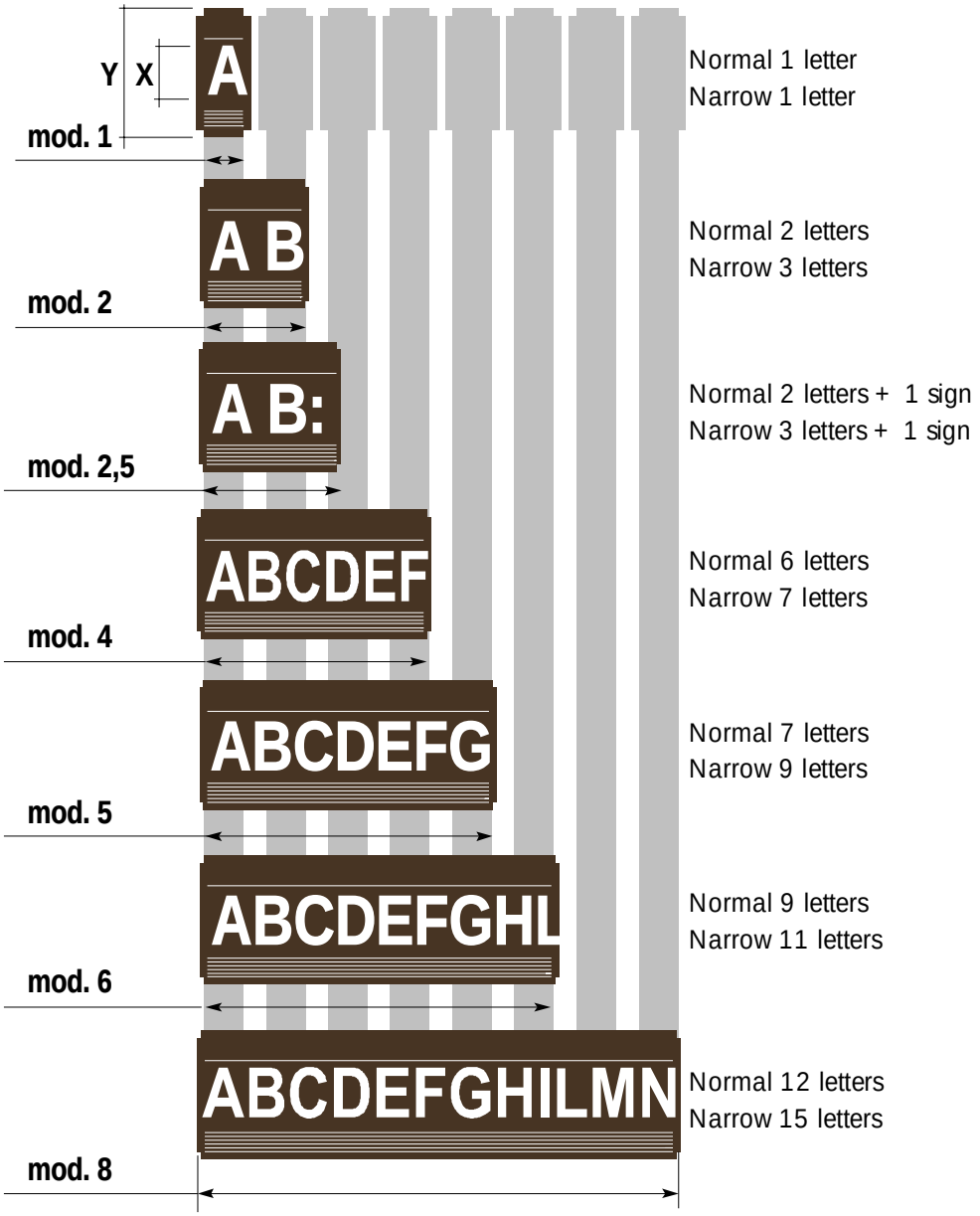
The reading angle and distance depend on the colours of the characters. Using Gill Sans Bold normal letters, white on black, the 35, 60 and 100 flap units allow a readability of 18, 35 and 60 meters respectively. Legibility is near perfect in most lighting conditions. The silk-screening process guarantees a good definition of the letters and allows the reproduction of multi-colour symbols (such as airline logos) and pictograms.

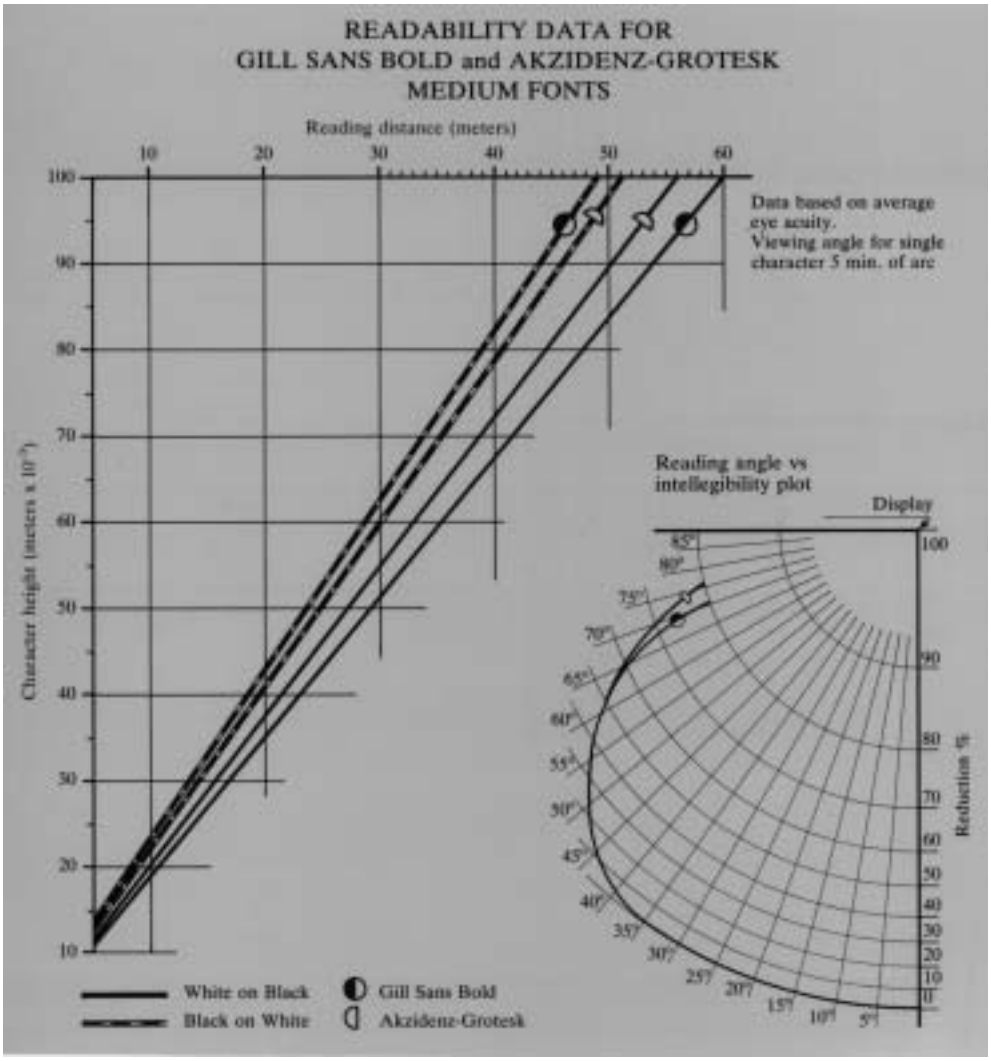
Flap units are equipped with stepper motors and work in synchronous mode according to a set of control and command signals generated by the CPU, including:

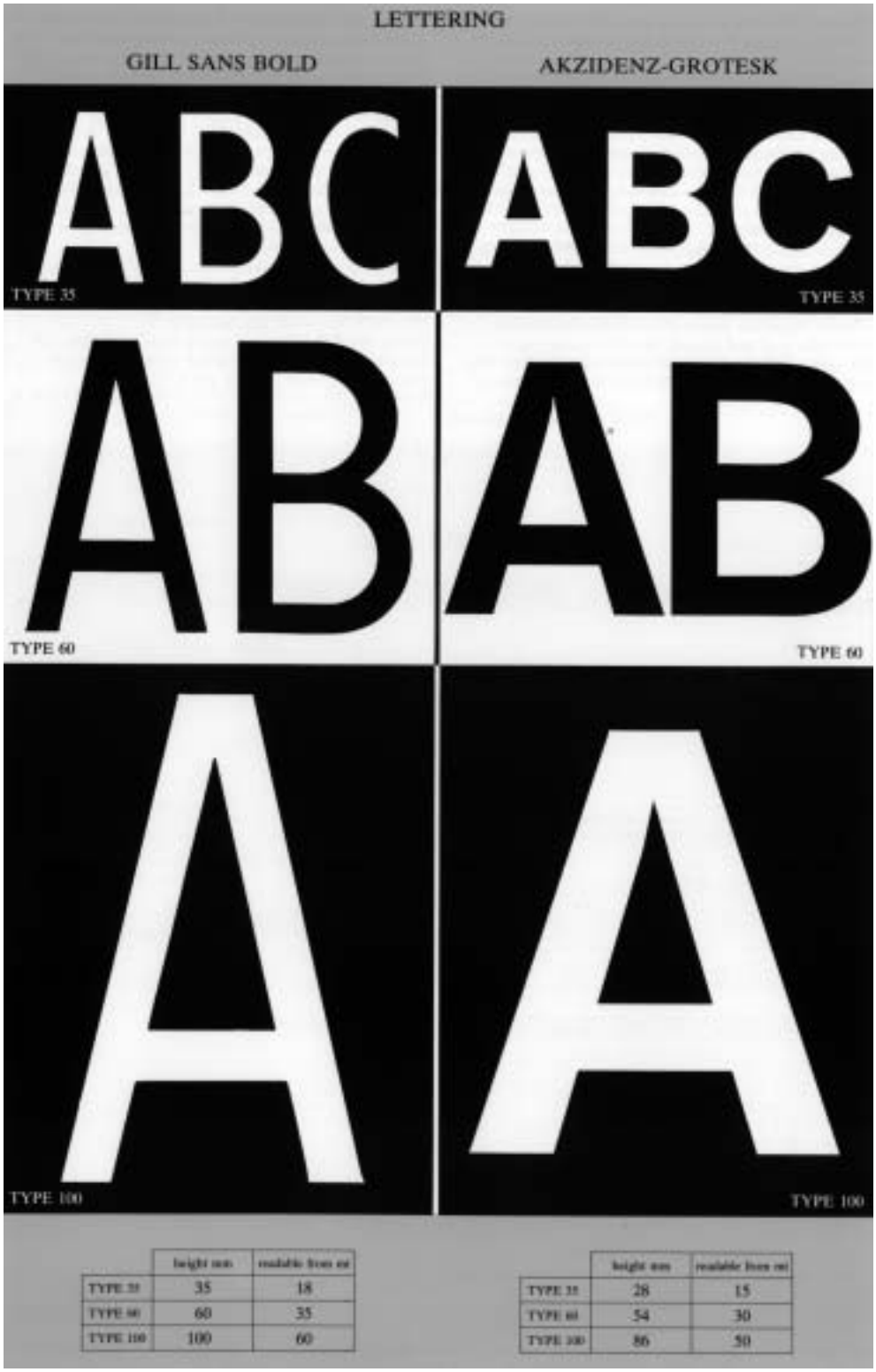
- ✓ Even and odd time-based signals (IP/ID)
- ✓ Position control signals (Zero / even-odd step)

The former signals drive the power bipolar pulse generated by the flap units power supplies (+/- 24 Vdc) and are synchronized, while the latter enable the Hall effect sensors located on the flap units.

Font: Gill Sans Bold




READABILITY DATA FOR
GILL SANS BOLD and AKZIDENZ-GROTESK
MEDIUM FONTS
Reading distance (meters)
10
20
30
40
50
60
100
90
80
70
60
50
40
30
20
10
Character height (meters x 10⁻³)
Data based on average eye acuity.
Viewing angle for single character 5 min. of arc
Reading angle vs intelligibility plot
Display
85°
80°
75°
70°
65°
60°
55°
50°
45°
40°
35°
30°
25°
20°
15°
10°
5°
100
90
80
70
60
50
40
30
20
10
0
Reduction %
White on Black
Black on White
Gill Sans Bold
Akzidenz-Grotesk



	height mm	readable from m
TYPE 35	35	18
TYPE 60	60	35
TYPE 100	100	60

	height mm	readable from m
TYPE 35	28	15
TYPE 60	54	30
TYPE 100	86	50

3.1 Electronics

The signboard is handled by a main controller (SBC). This device is used as an interface for the standard board controller related to the specific technology.

The SBC is a microprocessor-controlled device; it works in Slave mode connected to a Host by means of a serial asynchronous line.

It can adopt absolute and relative writing with the maximum mix flexibility within the same command.

The SBC3200 is a configurable device, able to drive up to 64 information (electrical) lines and a different number of flap units, simultaneously, placed on the same physical line or on more than one physical line of the board:

- SBC 3201 max. 32 f.u.
- SBC 3202 max. 64 f.u.
- SBC 3203 max. 96 f.u.
- SBC 3204 max. 128 f.u.
- SBC 3205 max. 160 f.u.
- SBC 3206 max. 192 f.u.
- SBC 3207 max. 224 f.u.
- SBC 3208 max. 256 f.u.
- SBC 3209 max. 288 f.u.
- SBC 3210 max. 320 f.u.

The electrical row is the set of flap units that can be put in operation at the same time. The physical row is the set of flap units of the display information regarding the same subject (train, train, etc.). The physical row can extend both in horizontal and in vertical.

An electrical row can correspond to more than one physical row, since it is possible to drive and control up to 320 rolls, distributed in several physical rows, at the same time. This option is used to reduce the updating time of the flap units board.

Therefore, the choice of the SBC's configuration has impact on the updating time of the whole display.

In fact, as the average updating time of an electrical line of a display [TL] is 7,2 sec with max 11.2 sec if on the line there are Flap Units type 100/8 Mod / 80 flaps, the time necessary to update the complete board is TB = TL x NE, where NE = number of electrical lines.

The communication with the Host is achieved by means of an asynchronous protocol derived from BSC (BINARY SYNCHRONOUS COMMUNICATION). In “Off-

line" mode it can execute some maintenance functions or flap unit reset using a simple control keyboard.

It allows multipoint connection on a serial line and it is possible to choose among the following standard interfaces:

- **RS485**

  This interface uses a balanced voltage line and allows a multi-point connection up to 2000 m on an unshielded twisted pair. Up to 32 stations can share the same line. Currently, a 4 cables version (full duplex) is available, but it is foreseen the introduction of an opto-isolated two cables version (half duplex). A particular attention has to be paid to the physical layout of the line and in the impedance adaptation. It is not limited regarding the transmission speed.

- **DSK**

  This is an interface that works by using small transformers, which inject bi-directional impulses onto the line. It has been adapted by Solari to meet the requirements of connections in multi-drop, for distances up to 2000 metres (transmission speed up to 9600 baud) or 1000 meters (transmission speed up to 19200 baud) and beyond, using simple two twisted telephone cable, unshielded. Up to 8 stations can be connected in multipoint on the same line in 4-wire (full-duplex) mode.

As alternative to the serial communication architecture, it is install the boards into a structured system with point-to-point connections of each board to the nearest switch hub of the station backbone.

In this case, the board is implemented with an **Ethernet 10baseT interface** that communicates with the SBC3200 with the asynchronous protocol described above and with TCP/IP protocol towards the Host.

A watchdog based auto-reset feature is fully supported, along with the possibility to receive a reset command from a serial line. Several configuration parameters can be stored on non-volatile memories (EEPROM).

The CPU board is equipped with 2 static digital outputs to handle a **blinking unit.** Each of them supplies a relay contact (isolated) with a maximum resistive load of 500 mA @ 30 Vdc or 40 Vdc. Four further digital inputs are provided for general-purpose use and can accept a contact closure. The working voltage is 24 Vdc and it is supplied by the logic power supply.

This interface includes a time-based output at 1,5 Hz ca. useful to drive the blinking module or to drive directly some row blinking lamps (given that the lamps are connected to the 24 Vdc source supplied by the logic power supply, the number of lamps that can be driven in such a way depends on the power consumption of the other devices contained on the flap unit board).

4. Operation

This train information is displayed in chronological order according to the schedule time of departure (STD).

Rearrangements of train information due to train disappearance or unit off will be automatic, under control of the computer and one line at a time without causing disturbance to the public.

During these updating operations, there is no loss of information. In fact, during unit-up, the first available train information is written in the first line free and than cancelled from the line where it was written previously, and so all the other lines.

During unit-off, the last train information (line "n") is cancelled and the previous information (line "n-1") is written in the row "n", before to be cancelled from line "n-1".

By this procedure, all the lines are shifted down in order to introduce the new train data in the right position according to the scheduled time.

If any information is missing at the time of presentation, the field will be left blank and completed when the information is available.

If any line or character of a board is malfunctioning, the Control System automatically blanks the line concerned and arranges the information to be displayed on the next line which function properly.

At the same time, a report of such malfunctioning is given at the System and Technical Support Consoles; in fact the microprocessor housed inside each board can specify the failed flap unit thanks to the effect Hall control placed in each flap unit and send report to the computer.

The failure of one or more modules (flap units) does not cause the malfunction of the whole System because only the line where the faulted units are placed is put out of order by the board controller with a report to the computer, while all other lines will work properly.

The displayed information is not deleted by a power surge or interruption, because power is required only during data transmission from/to computer and board controller and during flap unit rotation.

4.1 Sample Applications

Malpensa 2000 Airport

Milan – Italy

Departure Hall

Main Departure Board

3 sections - 25 rows per section - ECF 60

Malpensa 2000 Airport

Milan – Italy

Departure Board - 3 section x 25 lines each - ECF60

Termini Railway Station

Rome – Italy

Summary Arrival/Departure Boards

16 + 2 rows - ECF100

Paris – Gare du Nord

Summary Departure Board

19 x ECF100 + 3 x ECF35 rows