MIP737

Main Instrument Panel Control Board

This manual is intended for Flight Simulator use only and may not be used in any real world aviation application. The authors are not responsible for any errors or omissions.

FOREWORD

The MIP737 board allows managing switches pushbutton and LED annunciators for the Main Instrument panel of your B737NG simulator. The board has 44 digital outputs ready to drive LED's, 59 digital input for switches / pushbutton and 2 encoder input. A complete list of input outputs is on the last pages of this manual.

Note: This manual contains the latest information at the time of drafting. Due to the continuous evolving of the product some features could be been modified. Eventual later informations can be found at CPflight website www.cpflight.com

IMPORTANT NOTE!

The MIP737 board is an extension of the CPflight MCP hardware and requires CPflight MCP737, MCP737USB or MCP737PRO to operate. All the listed input outputs works with Project Magenta software depending by the Project Magenta installed software; some functions are related to PMsystem variables status, some to the MCP and glass cockpit. Even if the board can partially work with partial Project Magenta set-up, to have all parts full working you must have full Boeing package and PMsystem. To allows the Glass Cockpit display's and engine page swapping (MAIN PANEL DU's, LOWER PANEL DU selectors, "ENG" pushbutton etc), Project Magenta Glass Cockpit software has to be settled in extended mode. Select the extended mode (F6), disable the unused elements and resize displays on all machines.
With FS default 737 the board works partially (see the list of supported functions at: http://www.cpflight.com/sito/support/swcomptab.asp).
Drivers for PMDG series are distributed by Flightsimlabs, for more informations and the list of supported functions visit:
http://www.flightsimlabs.com/.

The connection of the MIP737 board requires somewhat technical capability. You have to know how to connect a switch or a LED, to solder wires, to understand the draw and schematic of this manual.
The board is supplied as it is; switches, LED's or other spare parts to put on your cockpit are not provided with the board; you may find all these parts on several online stores, CPflight is not organized to distribute spare parts, our aim is to provide a board to make these parts to works in conjunction with the MCP737 hardware.
It is very important that you know the functions that you need to implement in your cockpit and see on this manual if the board support and match your requirements. All the information to connect the MIP737 board are on this manual, the list on the last pages also give indications about where to use a steady or a momentary switch, a rotary selector, a pushbutton etc. There are not indications about model, dimension rating or shape for switches, you can use anything able to close a contact. Please do not email us with questions about which kind of switch use for a function, where to find LED's or question about thing already explained on this manual.
The digital outputs of the MIP737 board are settled to drive High efficiency LED's. The resistors for the LED's driving are built-in the board and no external resistors are required. In low current mode setting (see following pages) each output supply ~5mA to the LED; in High current mode setting each output supply ~10mA on each LED (in both case, standard 2V drop LED's are considered).

WARNINGS!

- **The use of MIP737 board without suitable knowledge could lead to damage of the electronic circuit; warranty does not cover damages due to incorrect wiring of any device.**
- **Do not connect anything in a different way from here indicated in this.**
- **The MIP737 board contains delicate Integrated Circuit (IC) chips. To protect them against damage from static electricity, you should follow some precautions whenever you work on connections:**
- **Always disconnect power supply before to work on the wiring.**
- **Use grounded wrist strap before handling components and wires. If you do not have one, touch both of your hands to a safely grounded object or to a metal object, such as the power supply case of your PC to discharge possible electrostatic charges.**
- **Pay attention to not cause short circuits on the board (for example with fragment of wires when working on the connections); keep the board clean and eventually cover the board when working on other part of your cockpit.**

SETTING UP

To allow the MIP737 board function, the MCP737 firmware revision has to be 1.12 or later (1.01 for the MCP737PRO version). If you have a previous version installed, upgrade the firmware to the last version, you may find it at download page: http://www.cpflight.com/sito/downloads/downloads.asp
More informations about the firmware update are reported on the MCP operation manuals (download the later revision at download page).
The MIP737 board is connected to the MCP through the 5 pole expansion socket. Connect a terminal of the enclosed 5 pole cable to one of the sockets (see Figure 1 A and B) and the other side to the AUX socket on the back of the MCP737. If you have other modules (for example an EFIS selector, a NAV radio etc) you can connect them to the second socket and so on (daisy-chain).

ALWAYS DISCONNECT POWER FROM THE MCP WHEN YOU CONNECT A NEW MODULE.

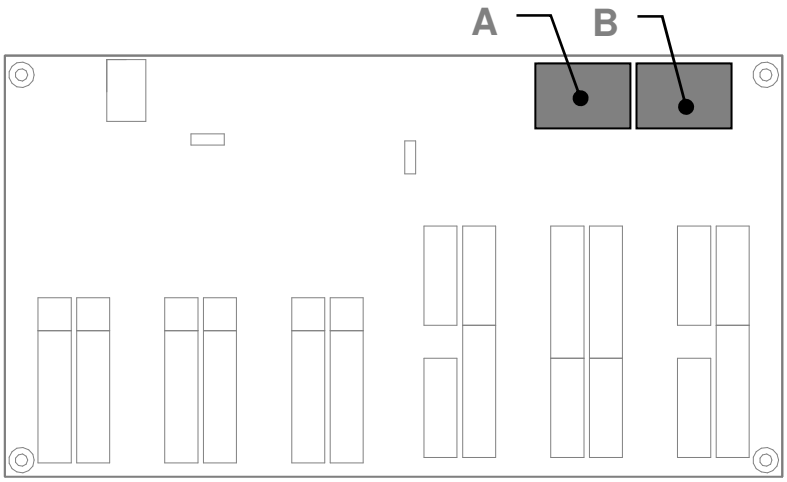


Figure 1

It is not relevant the sequence in the daisy-chain modules connection. Each module has two 5 pole plugs, one cable is connected to the previous module and the second plug allows connecting the successive one.
The MCP only have a single 5 pole connector as it function as a Master and manage signals for all other modules (see Figure 2).

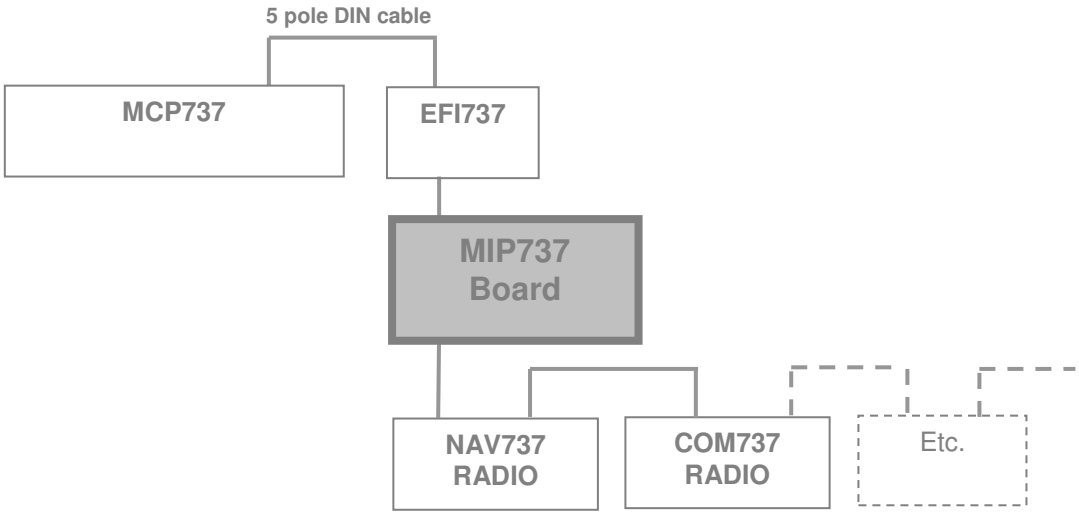


Figure 2 Daisy-chain structure

LED's

The board LED outputs can be configured for two different levels (Figure 3 jumper "C"). If you insert the jumper "C" in the lower position (L) the output current is settled to ~5mA; if you insert the jumper "C" in the upper position (H) the LED's current is increased to ~10mA (considering 2V drop LED's).
There are several type of LED's with differences in terms of forward voltage drop, nominal current, luminous intensity, viewing angle; also we cannot know the filtering effect of the cap you will place in front of the LED's. For these reason we cannot suggest specific part numbers for LED's; our suggestion is to make some test with different type of LED before to definitively assemble your pilot-lights. We recommend the use of High efficiency LED's to reduce the total power consumption and have more bright indications. The effect of the indication and warning lights will depends by the type of LED and also by the dimming of the annunciators glass; we recommend to use high efficiency LED only and to make some test with different type of LED's to match the brightness of different color LED (amber, red and green).

BOARD SUPPLY

The power supply for the MIP737 board (also supply the connected LED's) can be settled in two ways.
Referring to the below Figure 2 if you insert the jumper "B" to the Right (E) the power comes directly from the MCP737 through the daisy-chain (default setting). If you insert the jumper "B" to the Left (I) the power comes from the supply plug (Figure 3"A").
The necessity of an external supply it depends by the total load on the daisy chain. In most of applications an external supply is not required; with an high number of modules on the daisy chain (2 EFI737, 2 NAV737, 2 COM737, 1 ATC737 and 1 ADF737) the use of an external supply is advisable.

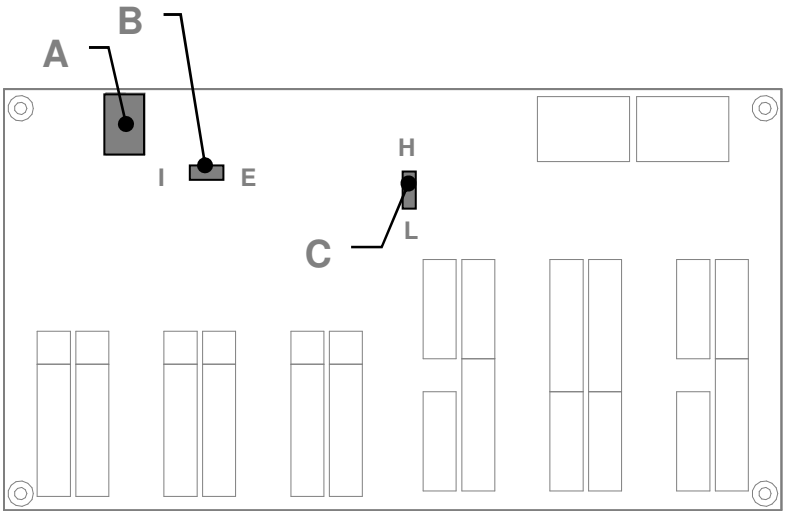
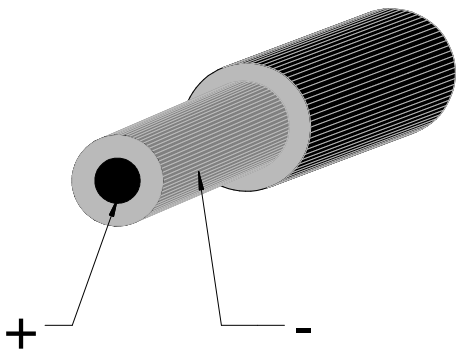


Figure 3

The characteristics of the external supply adapter (if needed) are:
Voltage: maximum range 6 to 12Vdc (optimal 7,5 to 9Vdc)
Current capability: at least 300mA
Connection: standard 2,1mm plug, positive inner.

WARNING! Do not invert the supply polarity as you can burn-out the MIP737 built-in voltage regulator. See draw:



If you use an external supply adapter place the "I/E" jumper to the "I" position. When powered by a supply adapter the MIP737 board has to be powered before to connect the supply to the MCP.

BUZZER

The buzzer placed on the board also is controlled by the software; it can be disabled inserting the jumper to the right (the jumper is located close to the buzzer).

WIRING

The MIP737 board is equipped with screw terminal blocks. Terminals may accept wires from 0,1 to 1mm^2 of section; don't use large wires, 0,14 to 0,25mm^2 are more suitable.
The function defining of each terminal block is given in the following pages of this document. Pay attention to the correct position of wires; errors in the connection may produce unpredictable behaviour in the functioning and also could lead to damage of the electronic circuit.

TIP: *Particular attention must be applied in the wire connection, do not set too long bare on wires to avoid short circuit between wires on the terminal blocks and reduce the wire length at least what is necessary.*
Do not wire all the devices in a single operation. Wire some function (for example a single terminal block group) and test them; when all is OK for these, continue with another group.

DIGITAL OUTPUT

Terminal block for LED's are arranged in groups (see Figure 4). Where possible each group drive LED's of a specific area, but due to the number of LED supported by each group (8) there are some exceptions. Groups are subdivided as follows:

Group A (terminals 1 to 10):	Captain side glare-shield
Group B (terminals 11 to 20):	Captain side Main Panel (excluding "STAB OUT OF TRIM" lamp)
Group C (terminals 21 to 40):	Center Panel (+ "STAB OUT OF TRIM" lamp)
Group D (terminals 41 to 50):	Copilot side Main Panel
Group E (terminals 51 to 60):	Copilot side glare-shield

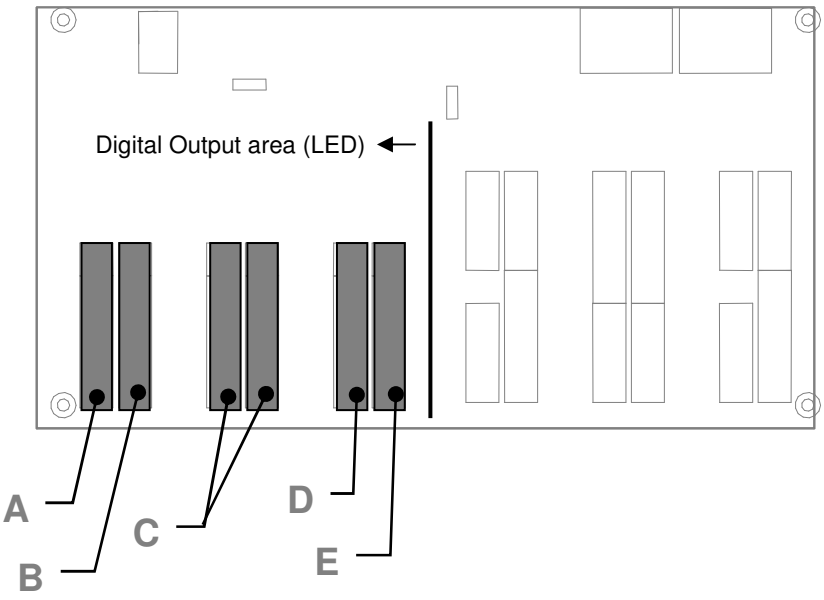
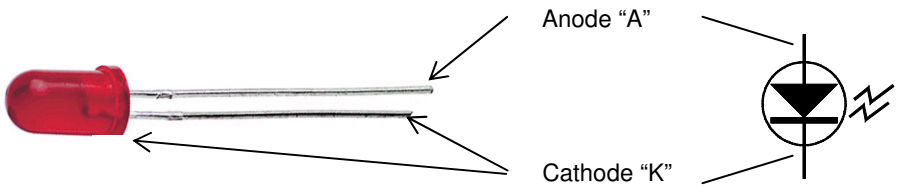


Figure 4

To connect the LED you have to respect the polarity. The LED has an Anode (referred as "A" in the tables) and a Cathode (referred as "K" in the tables). To identify the polarity look on the terminals of the LED; the Anode pin is a little longer than the cathode. Also in the round LED's, the Cathode pin is identified by a little flat area on the LED plastic body.



Each terminal block group has independent Anode for each single LED and a common pole to connect all Cathodes together. The common pole dispose of two terminal block (see figures on next pages).
To better spread the light in some case you will need to place two LED's on a single annunciator. This can be done connecting the two LED's in series (use high efficiency and low drop voltage LED's). The two LED's will have less brightness respect a single one, but the sum of the two and the better spread can give better results. Make tests…
If you need to test your connections without having to run Project Magenta (and generate the warning condition to light the LED) you may do it using the TestMip.exe utility. Download at: http://www.cpflight.com/sito/downloads/downloads.asp

DIGITAL INPUT

IMPORTANT! To allow the Glass Cockpit display selection controlled by the MIP737 board (MAIN PANEL DU's, LOWER PANEL DU switches etc), Project Magenta Glass Cockpit software has to be settled in extended mode (F6). Select the extended mode, disable the unused elements and resize displays.

The board has 59 digital input and 2 encoder input for switches, rotary switches and pushbutton. The inputs are arranged in groups (see Figure 5). Each group control a specific area with some exceptions as follow:

Group A (terminals 1 to 10): Captain side glare-shield
Group B (terminals 7 to 26): Captain side Main Panel (terminals 13 to 16 also attend to Copilot side)
Group C (terminals 27 to 54 and 61 to 66): Center Panel
Group D (terminals 70 to 80): Copilot side Main Panel
Group E (terminals 55 to 60): Copilot side glare-shield

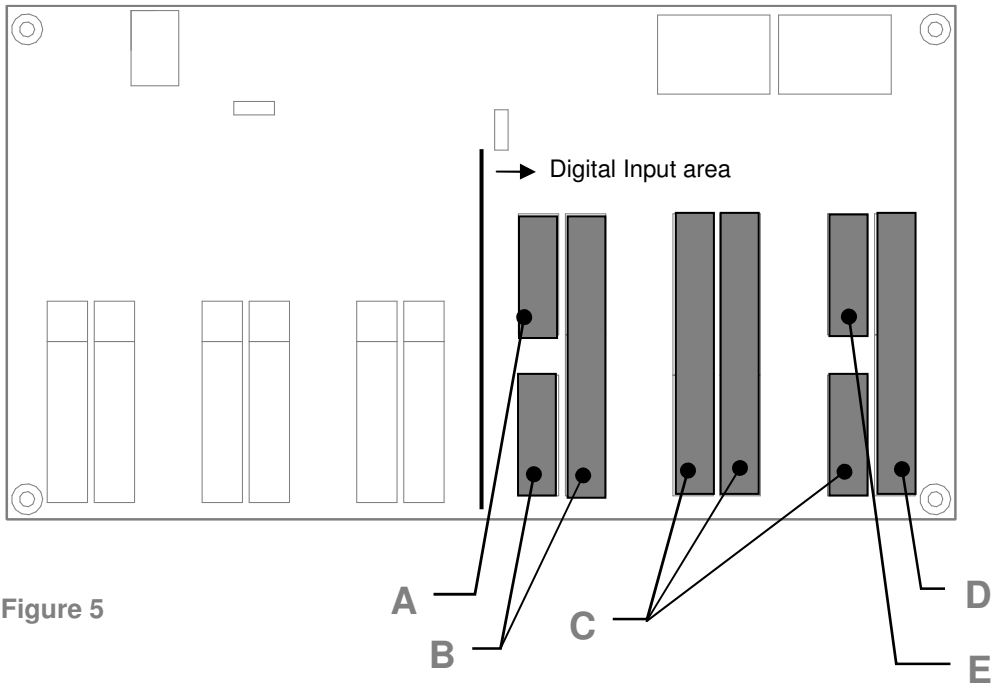


Figure 5

Some of the MIP devices have pilot-light and button switch built in a single unit (for example the A/P–A/T-FMC disconnect warnings). You may build these assembling in several way, in the picture of Figure 6 you can see an assembly for this area using OMRON pushbutton + lamp. The lamp has been substituted with two separate LED's, For information you may see below the OMRON part code for this switch assembly, in any case there are many manufacturer for similar indicator-switch (EAO, Honeywell, Rafi, Moeller etc), and also you can realise the part using separate pushbutton and LED.

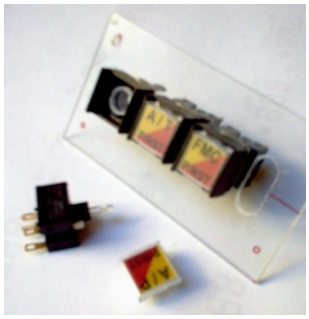
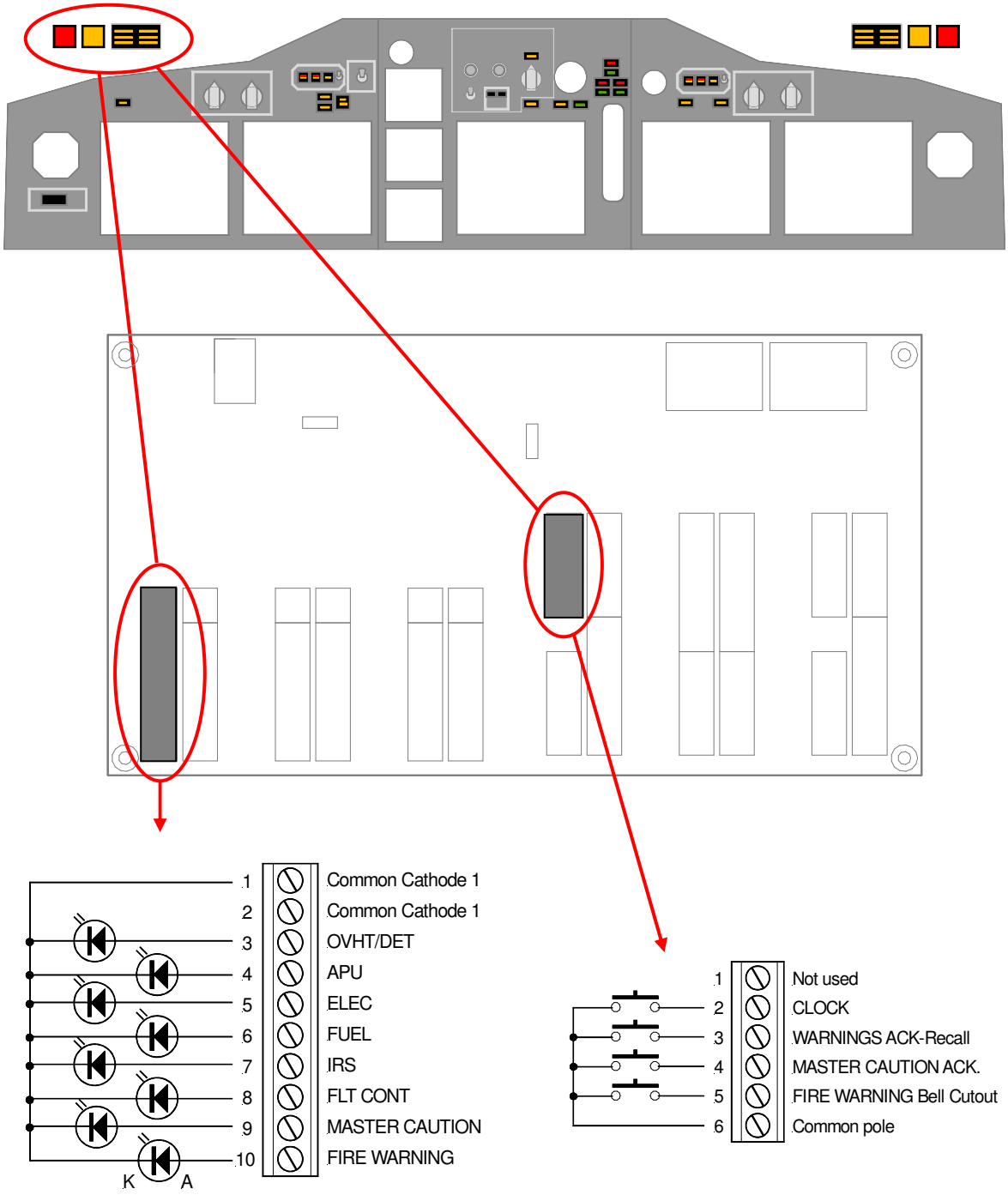


Figure 6

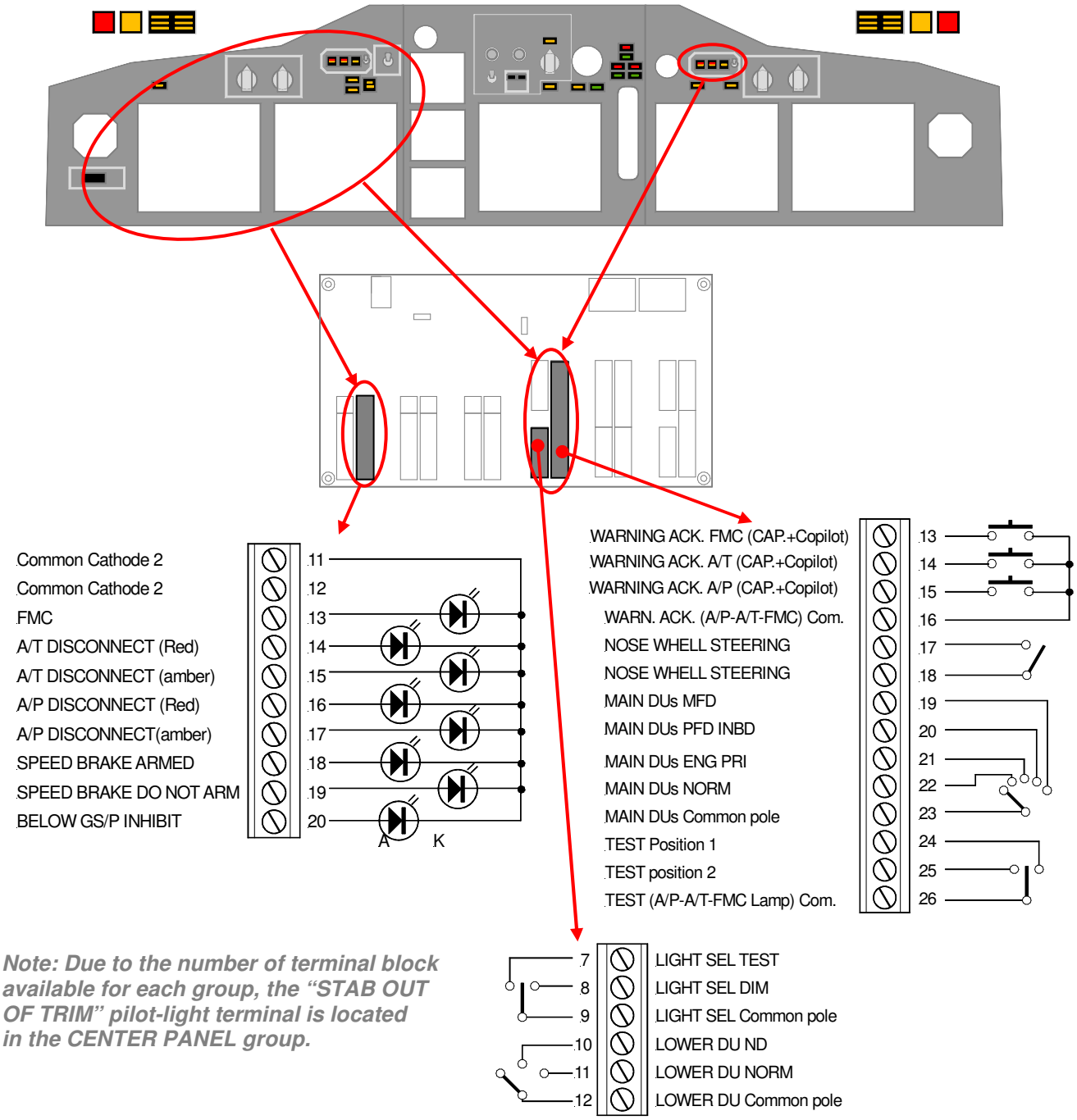
Part codes:
- Switch Body: OMRON A165-CAM
- Contact group: OMRON A16-1
  - Translucent Glaze + cover cap: OMRON A165L-AW

CAPTAIN SIDE GLARE-SHIELD



The above draw shows how to connect LED's and pushbutton for the Captain side glare-shield. Note that each LED anode "A" is wired to a single terminal block; all cathodes are wired together and connected to a common cathode terminal. There are two terminals dedicated to the common cathode, you can indifferently use one, the other or both (if you mean to wire the LED cathode in two groups).
The glare pushbuttons allow the acknowledgment of warnings. Depending by the current alarm status the pushbutton action shut-down the warning, get steady a flashing light or extinguish a warning signal. Note that the 6 warning lamp indication plate also have pushbutton function. Pushing the button the warning extinguish while pushing again you recall the warning status again and the lamp will illuminate if the warning condition still persist. Functioning and logics in the warnings acknowledgment/recall is managed by Project Magenta software.

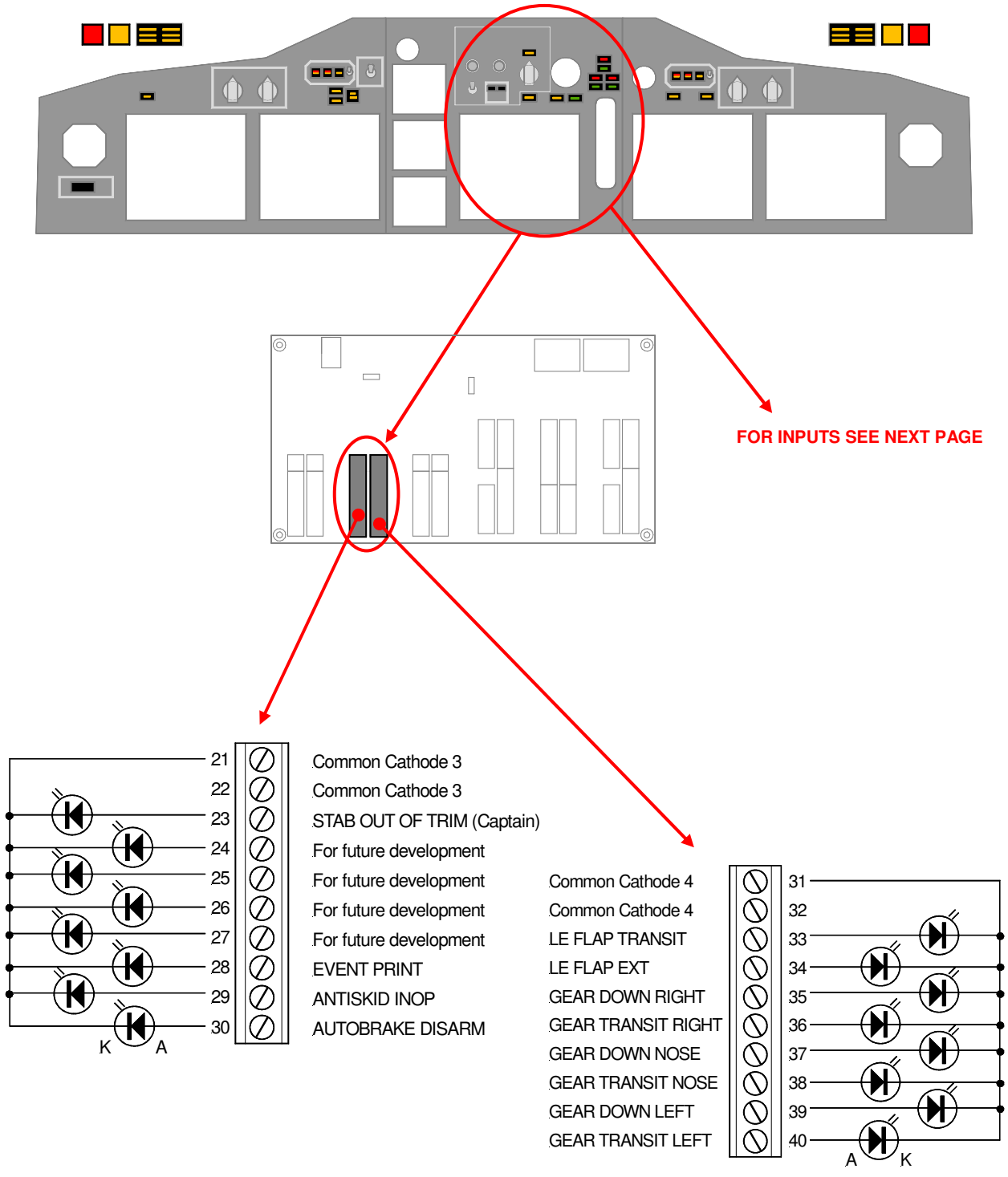
CAPTAIN PANEL



Note: Due to the number of terminal block available for each group, the "STAB OUT OF TRIM" pilot-light terminal is located in the CENTER PANEL group.

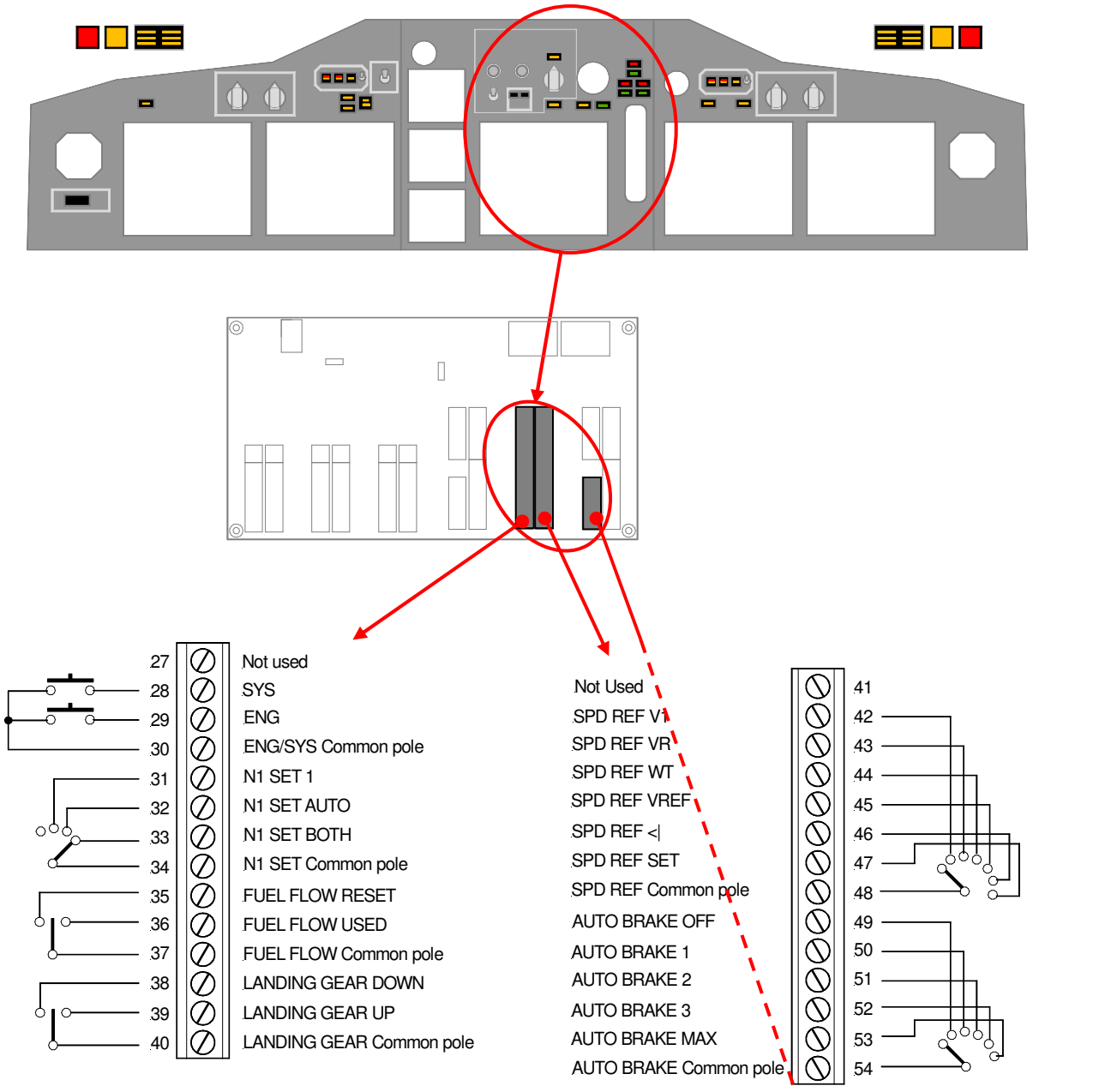
The above draw show how to connect LED's and switches for the Captain Panel. Consider the same concepts of glare-shield section for LED connection. The "BELOW GS/P INHIBIT" pushbutton acknowledgement (if any) is in common with the Copilot side (terminals 68/69).
About inputs, note that in the multi-position switches (rotary or toggle) always there is an unconnected pole/position. For example the "Lower DU" selector is a 3 position rotary switch (refer to the above draw), but 2 position only are connected to the board (as well as the common pole). The third position is given by default when the rotary switch do not close any pole and lie on the unconnected position. The same concept must be applied to all other multi-position switches (see also "Function Defining" table forwards in this manual. In detail the selected functions for each control when positioned to the unconnected pole are:
MAIN PANEL DU's selector: "OUTBD PFD"
LOWER DU selector: "ENG PRI"
LIGHT SEL three position switch: "BRT"

CENTER PANEL LED's



The above draw shows how to connect LED's for the Center Panel. Consider the same concepts of previous sections for LED connection. Each driver group is arranged to drive 8 light. The captain panel requires 9 LED, so the "STAB OUT OF TRIM" light terminal is located in the Center panel group (terminal no. 23) also if related to the Captain panel. The related cathode should be wired to the Common Cathode 3 (terminal 21 or 22) together with other Center panel lights (see above draw).

CENTER PANEL DIGITAL INPUT



In the multi-position switches (rotary or toggle) the unconnected position select the missed item of the related control. In detail the selected function for each control when positioned to the unconnected pole are:

N1 SET selector: "2"
FUEL FLOW 3 position switch: "RATE"
LANDING GEAR 3 position switch: "OFF"
AUTOBRAKE selector: "RTO"
SPD REF selector: "AUTO"

Considerations about SPD and N1 SET on the next page…

CENTER PANEL ENCODER INPUT

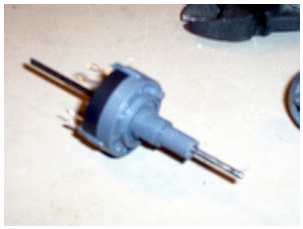
The MIP737 board accepts input for 2 encoders dedicated to “SPD REF” and “N1 SET” bug regulation. The 737 use for these functions a group with selection and regulation on a single unit having two knobs on a concentric shaft (selections on the large external knob and regulation on the small internal one). Unfortunately it is not easy to find this device on the market and you shall place the encoder upwards, above the selector. If you have a good skill in the tinker you can take on to realize this assembling by yourself. In the below pictures you may see an example of this work using a C&K 45° step rotary switch. This is only an example and it does not want to be an instruction; please **do not** ask to CPflight for these parts:

- Disassemble the rotary switch, pay attention as there is a spring that push two spheres to get the detents, all can fly better than your aircraft when you open the switch (1);
- Perforate the plastic shaft (3mm) and insert a small 2x3mm pipe (2);
- Cut in two parts the spiral spring to allows to pass through with the pipe (3);
- Assemble the rotary (not easy…) and insert a 2mm steel shaft for the encoder (4)
- A small piece of the same pipe can be used to adapt a 3mm shaft knob.

1

2

3


4

5

The “SPD REF” and “N1 SET” regulation input supports mechanical encoders; the required characteristics are:

- Encoder type: Mechanical
- Output: A and B signals proportionate to phase difference (see Figure 7)
- Rating: >=1mA 5Vdc.

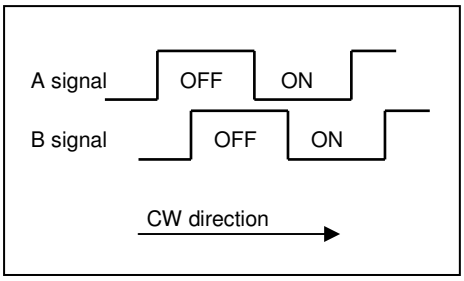


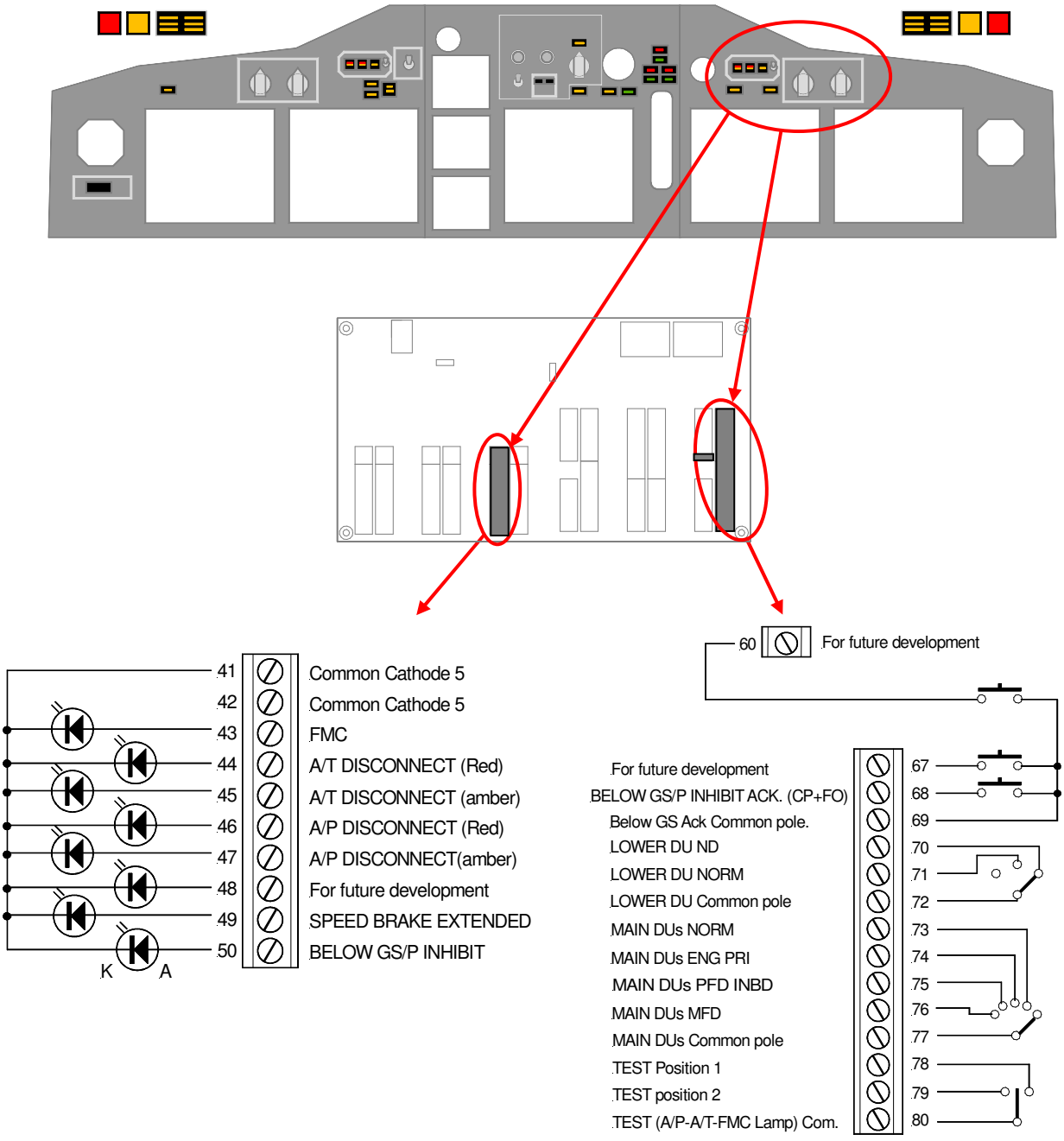
Figure 7

The data about resolution, type and material of shaft, dimensions, torque etc. are not mandatory and depends on your preferences.
The encoder type is one of most commonly available by several manufacturer, following you find some indications for applicable encoders, but also any from other manufacturer having the above characteristics may be useful.

MANUFACTURER	PART CODE
ALPS	EC11 series EC12 series EC16 series
BOURNS	3315 series ECW series PEC11 series PEC12 series PEC16 series
ITT	NSE10 series NSE11 series NSE12 series NSE16 series

The encoder have three pin (some have 5 pin as includes a push-on switch), the pins are “A”, “B; and “C”. Usually the center pin is the “C” that is the common pole and has to be connected to the Common pole terminal of the board, but depending by the model the common pin may be in other position; check on encoder datasheet that may be easily found on the manufacturer web-site. Once connected, if the encoder works with reverse action, simply swap the connection on the “A” and “B” terminals.

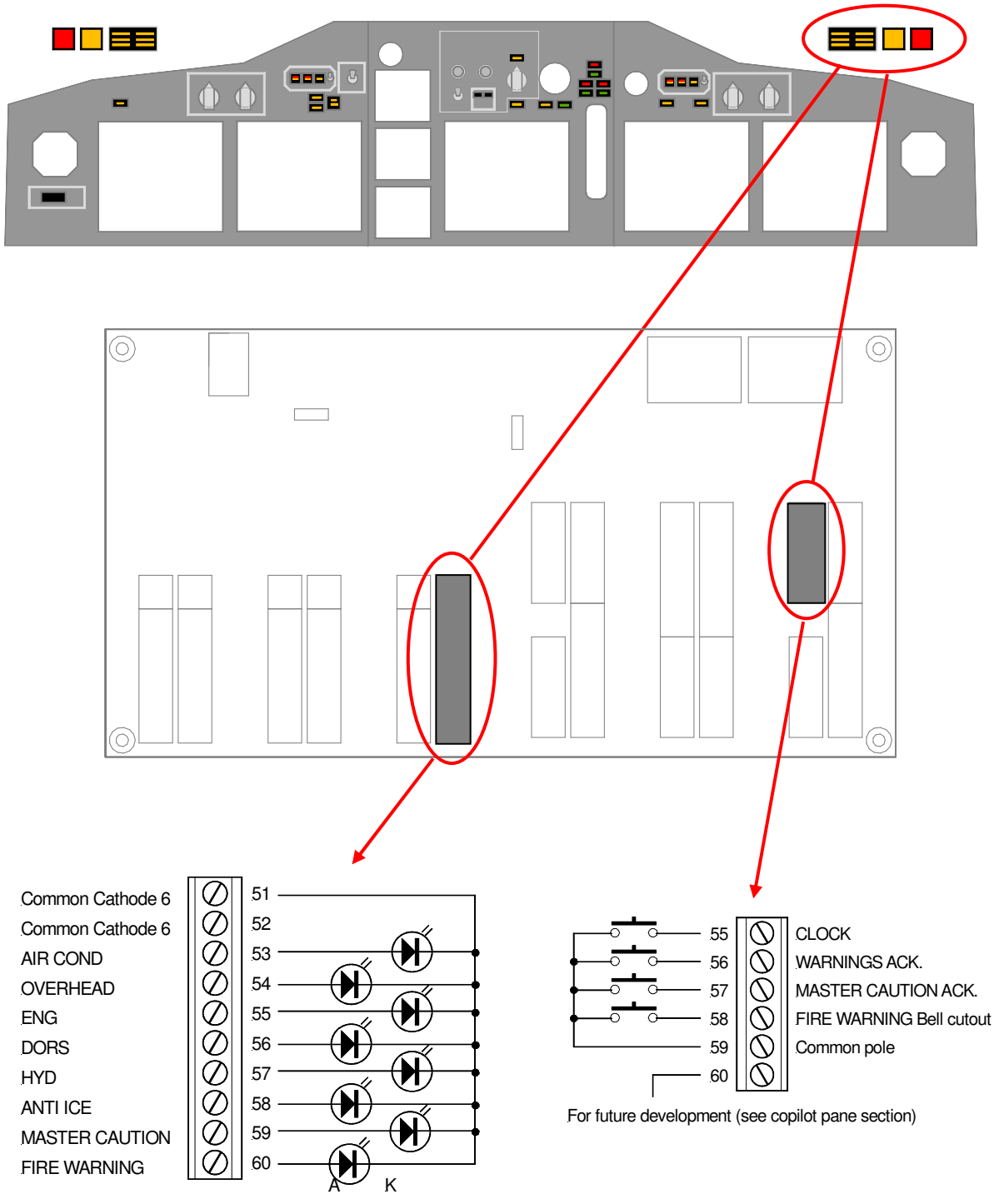
COPILOT PANEL



The above draw show how to connect LED's and switches for the Copilot Panel. Consider the same concepts of previous section for LED connection.
The "BELOW GS/P INHIBIT" pushbutton acknowledgement (if any) also attends the Captain side; connect the two pushbuttons in parallel. Note that in this area the rotary switches (MAIN DU's and LOWER DU) are reverse connected respect the Captain side; this because the switches are mirrored; where on the Captain side you leave unconnected the first counter-clockwise position, on the Copilot side the unconnected position has to be on the last clockwise position. The selected function when the switches lie to the unconnected pole is:

MAIN PANEL DU's selector: "OUTBD PFD"
LOWER DU selector: "ENG PRI"

COPILOT SIDE GLARE-SHIELD



The above draw shows the connections for the Copilot side glare-shield. Consider the same concepts of previous section for LED connection.
The glare pushbuttons allow the acknowledgment of warnings. Depending by the current alarm status the pushbutton action shut-down the warning horn, get steady a flashing light, extinguish or recall a warning signal.

DIGITAL OUTPUT TABLE (LED's)

Note:
- = Not used.
K = LED cathode
A = LED anode .

AREA	INDICATOR	COLOR	Terminals		NOTE
			K	A	
CAPTAIN SIDE GLARE-SHIELD	OVHT/DET	AMBER	1/2	3	
	APU	AMBER	1/2	4	
	ELEC	AMBER	1/2	5	
	FUEL	AMBER	1/2	6	
	IRS	AMBER	1/2	7	
	FLT CONT	AMBER	1/2	8	
	MASTER CAUTION	AMBER	1/2	9	
	FIRE WARNING	RED	1/2	10	
CAPTAIN SIDE MAIN PANEL	FMC	AMBER	11/12	13	
	A/T DISCONNECT	RED	11/12	14	
		AMBER	11/12	15	
	A/P DISCONNECT	RED	11/12	16	
		AMBER	11/12	17	
	SPEED BRAKE ARMED	GREEN	11/12	18	
	SPEED BRAKE DO NOT ARM	AMBER	11/12	19	
	BELOW GS / P INHIIBIT	AMBER	11/12	20	
	STAB OUT OF TRIM	AMBER	21/22	23	
CENTER PANEL	-	-	21/22	24	
	-	-	21/22	25	
	-	-	21/22	26	
	-	-	21/22	27	
	EVENT PRINT	AMBER	21/22	28	
	ANTISKID INOP	AMBER	21/22	29	
	AUTOBRAKE DISARM	AMBER	21/22	30	
	LE FLAP TRANSIT	AMBER	31/32	33	
	LE FLAP EXT	GREEN	31/32	34	
	GEAR DOWN RIGHT	GREEN	31/32	35	
	GEAR TRANSIT RIGHT	RED	31/32	36	
	GEAR DOWN NOSE	GREEN	31/32	37	
	GEAR TRANSIT NOSE	RED	31/32	38	
	GEAR DOWN LEFT	GREEN	31/32	39	
	GEAR TRANSIT LEFT	RED	31/32	40	
COPILOT SIDE MAIN PANEL	FMC	AMBER	41/42	43	
	A/T DISCONNECT	RED	41/42	44	
		AMBER	41/42	45	
	A/P DISCONNECT	RED	41/42	46	
		AMBER	41/42	47	
	-	-	41/42	48	
	SPEED BRAKE EXTENDED	AMBER	41/42	49	
	BELOW GS / P INHIIBIT	AMBER	41/42	50	
COPILOT SIDE GLARE-SHIELD	AIR COND	AMBER	51/52	53	
	OVERHEAD	AMBER	51/52	54	
	ENG	AMBER	51/52	55	
	DORS	AMBER	51/52	56	
	HYD	AMBER	51/52	57	
	ANTI-ICE	AMBER	51/52	58	
	MASTER CAUTION	AMBER	51/52	59	
	FIRE WARNING	RED	51/52	60	

DIGITAL INPUT TABLE

com = common pole (for encoders, rotary switches etc).
on = steady position.
“on” = momentary action
Open = device positioned on unconnected pole.

AREA	FUNCTION	DEVICE TYPE	Terminals		NOTE
			1 (com)	other	
CAPTAIN SIDE GLARE-SHIELD	CLOCK	Pushbutton	6	2	
	WARNINGS ACK-Recall	Pushbutton	6	3	
	MASTER CAUTION ACK	Pushbutton	6	4	
	FIRE WARNING Bell Cutout	Pushbutton	6	5	
CAPTAIN SIDE MAIN PANEL	FMC MESSAGE RESET	Pushbutton	16	13	Also attend Copilot side
	A/T DISCONNECT RESET	Pushbutton	16	14	Also attend Copilot side
	A/P DISCONNECT RESET	Pushbutton	16	15	Also attend Copilot side
	BELOW GS/PINHIBIT RESET	Pushbutton	-	-	In parallel with Copilot side
	NOSE WHEEL STEERING	Off/on switch	18	17	
	MAIN PANEL DUs: MFD	5 pos rotary	23	19	
	MAIN PANEL DUs: PFD INBD			20	
	MAIN PANEL DUs: ENG PRI			21	
	MAIN PANEL DUs: NORM			22	
	MAIN PANEL DUs: OUTBD PFD			open	
	A/P A/T FMC Test lamp pos. 1	“on”/off/”on” switch	26	24	
	A/P A/T FMC Test lamp pos. 2			25	
	A/P A/T FMC Test lamp norm			open	
	LIGHT SEL TEST	On/off/on switch	9	7	
	LIGHT SEL DIM			8	
	LIGHT SEL BRT			open	
	LOWER DU: ND	3 pos rotary	12	10	
	LOWER DU: NORM			11	
	LOWER DU: ENG PRI			open	
CENTER PANEL	MFD SYS	Pushbutton	30	28	
	MFD ENG	Pushbutton	30	29	
	N1 SET: 2	4 pos rotary	34	open	
	N1 SET: 1			31	
	N1 SET: AUTO			32	
	N1 SET: BOTH			33	
	N1 SET Regulation	Encoder	66	64/65	
	FUEL FLOW: RESET	On/off/on switch	37	35	
	FUEL FLOW: USED			36	
	FUEL FLOW: RATE			open	
	LANDING GEAR: DOWN	On/off/on switch	40	38	
	LANDING GEAR: UP			39	
	LANDING GEAR: OFF			open	
	SPD REF: V1	7 pos rotary	48	42	
	SPD REF: VR			43	
	SPD REF: WT			44	
	SPD REF: VREF			45	
	SPD REF: <|			46	
	SPD REF: SET			47	
	SPD REF: AUTO			open	
	SPD REF Regulation	Encoder	63	61/62	
	AUTOBRAKE: OFF	6 pos rotary	54	49	
	AUTOBRAKE: 1			50	
	AUTOBRAKE: 2			51	
	AUTOBRAKE: 3			52	
	AUTOBRAKE: MAX			53	
	AUTOBRAKE: RTO			open	

AREA	FUNCTION	DEVICE TYPE	Terminals		NOTE
			1 (com)	other	
COPILOT SIDE MAIN PANEL	For future development	Pushbutton	69	60	
	For future development	Pushbutton	69	67	
	BELOW GS/PINHIBIT RESET	Pushbutton	69	68	
	FMC MESSAGE RESET	Pushbutton	-	-	In parallel with Captain side
	A/T DISCONNECT RESET	Pushbutton	-	-	In parallel with Captain side
	A/P DISCONNECT RESET	Pushbutton	-	-	In parallel with Captain side
	LOWER DU: ND	3 pos rotary	72	70	
	LOWER DU: NORM			71	
	LOWER DU: ENG PRI			open	
	MAIN PANEL DUs: NORM	5 pos rotary	77	73	
	MAIN PANEL DUs: ENG PRI			74	
	MAIN PANEL DUs: PFD INBD			75	
	MAIN PANEL DUs: MFD			76	
	MAIN PANEL DUs: OUTBD PFD			open	
	A/P A/T FMC Test lamp pos. 1	"on"/off/"on" switch	80	78	
	A/P A/T FMC Test lamp pos. 2			79	
	A/P A/T FMC Test lamp norm			open	
COPILOT SIDE GLARE-SHIELD	CLOCK	Pushbutton	59	55	
	WARNINGS ACK/Recall	Pushbutton	59	56	
	MASTER CAUTION ACK	Pushbutton	59	57	
	FIRE WARNING Bell cutout	Pushbutton	59	58	

LINKS

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