SPECIFICATION
FOR
CME8000
DEMO APPLICATION

FOR DEMO BOARD VERSION 3.0

Project:	CM8000-DEMO-0803/01
Project Description:	Demo Application with CME8000
Customer:	C-MAX
Controller-type:	S1C636C4/S1C6F666 Seiko Epson
Controller-code:	N/A

1 General Description

i. Local time in hours/minutes/seconds + Time Zone Indicator
Date as day of the week/month/day or World Time as UTC in h/min

ii. Alarm – 2 separate daily alarms settable with snooze function.

iii. Date Alert
The date alert is a silent alarm that flashes on the LCD display on the day set, it continues to flash the entire day.

iv. Time zone display in three different ways:
a. Indicator pointing to time zone as indicated by 4 bars.
b. Deviation from UTC in hours
c. Local time in hr/min/sec
(manual adjustment to Daylight Saving possible)

v. Stop watch functions in three different ways:
- Elapsed time
- Split time
- Lap time

vi. Low battery function
The micro controller S1C636C4 / S1C6F666 provides a circuit to detect low voltage. This function will be activated once a minute after the RESET. In the software, the detection level was set to 2.3V. Below this value, the BATTERY symbol (indicated by a bar) will disappear. Too low power is indicated by a flashing BATTERY symbol. If the battery voltage is above 2.3V, the BATTERY symbol is on permanent.

vii. Back light
Lights up an LED indicating the activation of an EL backlight by pressing button S2 shortly. The LED will light up for approx. 2 -3 seconds. To keep the light on, keep the button pressed.

viii. Radio signal reception checks automatically or manually

Radio reception signal check is indicated by the flashing of the radio tower symbol.
The demo application automatically receives a time protocol :

- After RESET
- At the time set for the 3 reception trials set in the RT mode.

The demo application starts reception when:

- pressing button S5 for longer than 2 seconds in mode 1 (main display).
- In mode 6, country scanning is activated by pressing S4 when SCAN is displayed.
- Japan dual frequency reception is also possible by pressing S4 when DUAL is chosen from the menu in this mode.
- In mode 6, dedicated signal reception is activated by choosing the desired signal for reception by S3 or S5, then pressing S4 when RX and desired signal icon displayed.

If during the receiving mode the alarm starts, the receiving mode will be interrupted and will be restarted after the alarm has ended. When other functions are being activated (for example during the running of the stop watch), reception will not be interrupted.

ix. Reception Information

Information regarding reception including duration for successful reception and local time when signal is synchronized is displayed in a separate sub-menu for the user to evaluate reception capability. This menu is only for display purposes, and no editing of information is necessary.

x. Comparison Level

Three different sets of comparison algorithm is preset in the application. Via the comparison level (CL) sub-menu, selection can be made between high security algorithm and low security algorithm. By pressing S4 for longer than 2 secs, the user can toggle the 3 different levels using the S3 or S5 buttons.

xi. Reception Initiation time

The time to start reception automatically can be programmable via an easy to use interface. 3 different times can be set according to the user's own wish in 24 hour format. Once time is set, reception of signal will start automatically at set time on the previous received radio control protocol. Pressing the S4 button for longer than 2 secs enters the edit mode. By pressing S1, one can switch between the 3 different reception times, adjusting the time is possible via buttons S3 and S5.

xii. Reception Duration

The duration for each reception trial can be freely set in the RD submenu. Sensible duration that should be set is within 2 minutes and 23 hours 58 minutes.

xiii. Field by field comparison

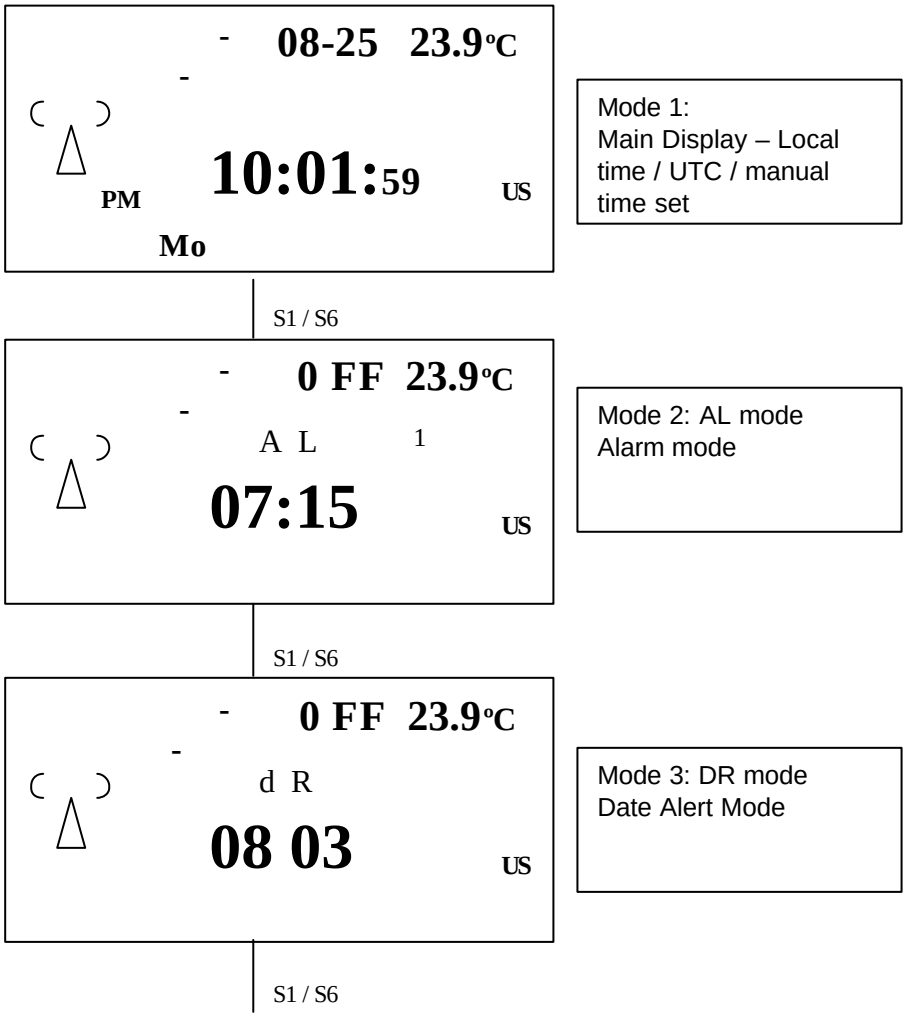
Different applications may have different requirements of the time information, meaning that some applications may only need the hour and minutes information whilst others require also the date and year information for example. Anticipating this, we allow the users to set by themselves which field of time information they need to use and to set therefore the relevant field for comparison. Setting these fields does not mean that these information are not displayed. Setting them for comparison implies that displayed information are secure and proven information.

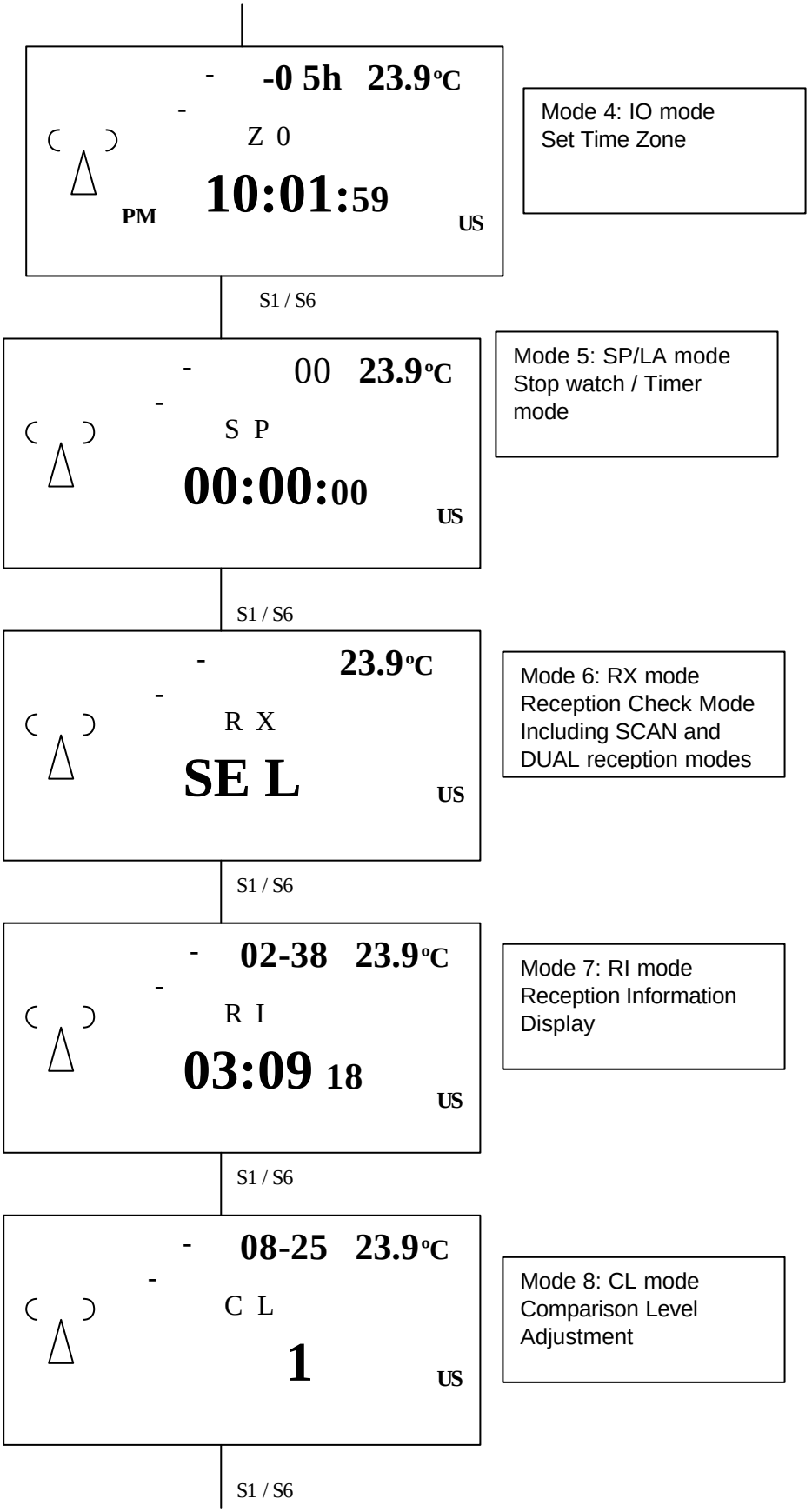
xiv. Testing of analog output of CME8000

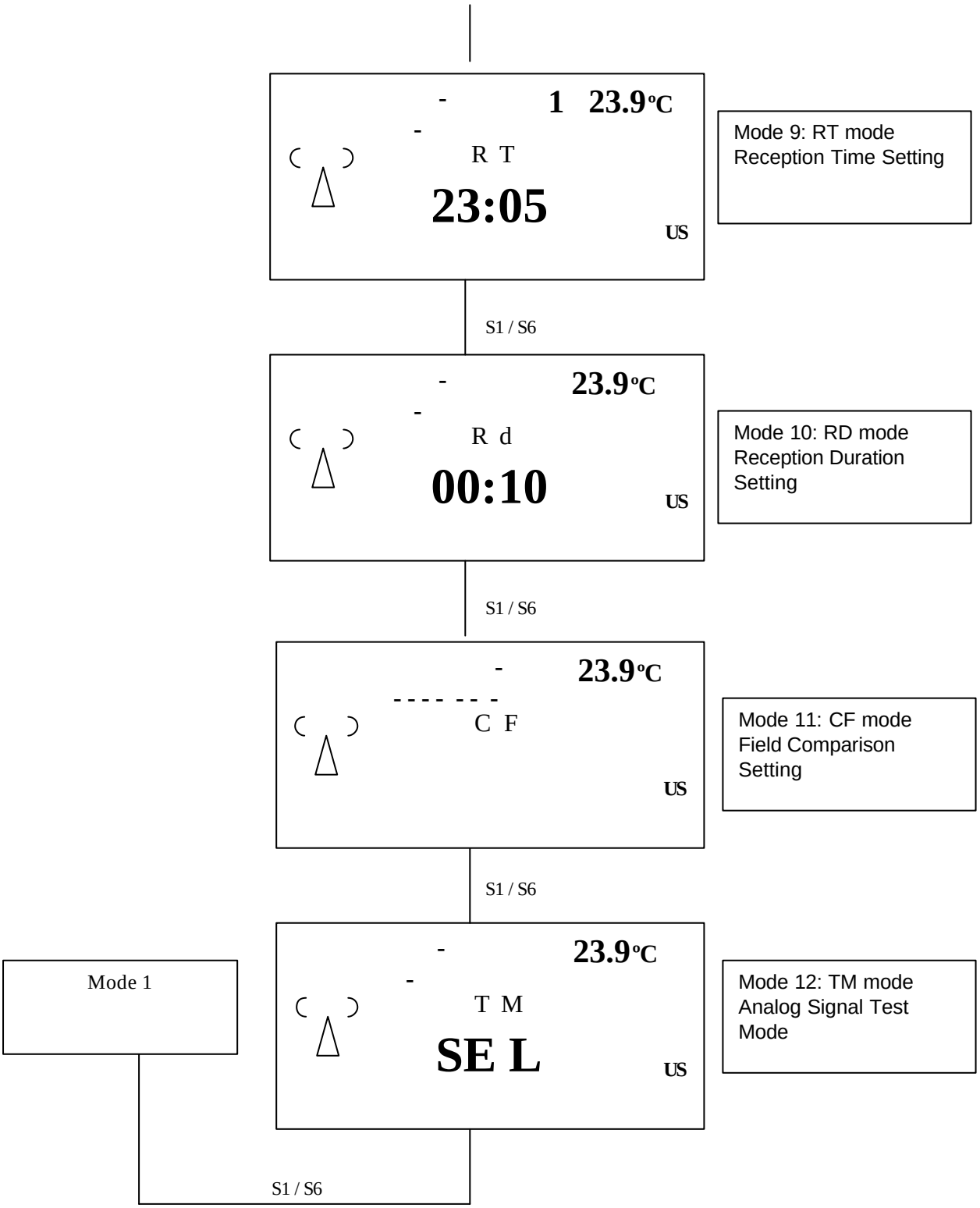
For ease of testing the analog front-end portion of the CME8000, a test mode is programmed to show the analog pulse output at different set protocols. The desirable signal to see from the TEST pin output can be manually set in the TM submenu. A visual effect of the analog output during scan is also available in this submenu.

2 Mode Overview

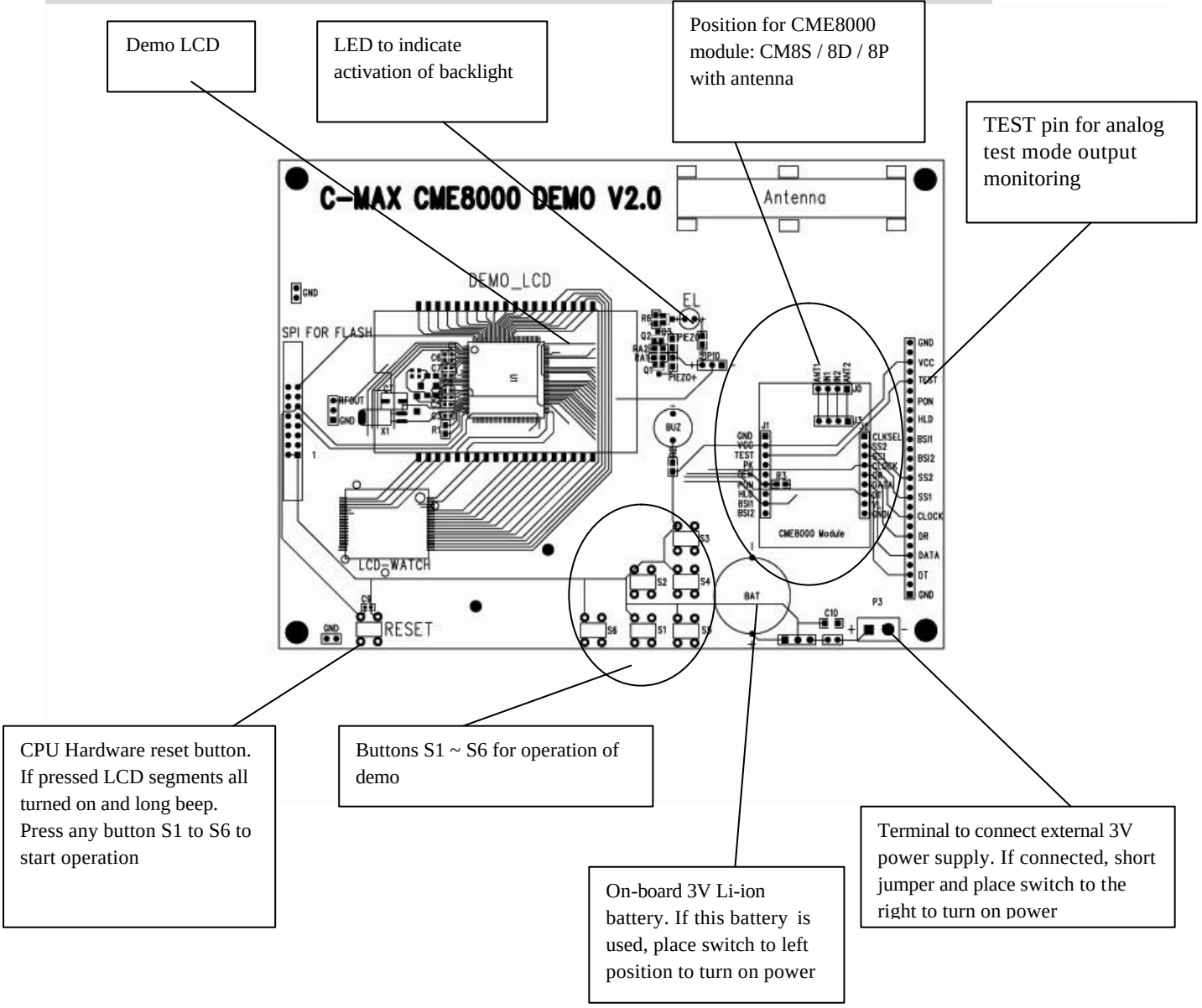
Note: display assumed reception done on US protocol in the past 24 hour



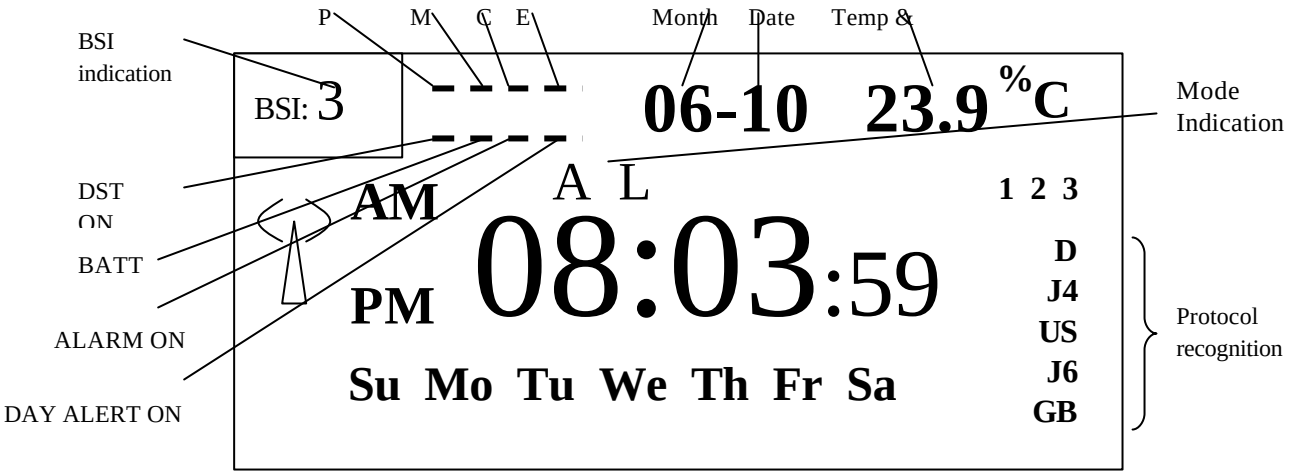

- -0 5h 23.9°C
Z 0
PM
10:01:59
US
Mode 4: IO mode
Set Time Zone
S1 / S6
- 00 23.9°C
S P
00:00:00
US
Mode 5: SP/LA mode
Stop watch / Timer mode
S1 / S6
- 23.9°C
R X
SE L
US
Mode 6: RX mode
Reception Check Mode
Including SCAN and DUAL reception modes
S1 / S6
- 02-38 23.9°C
R I
03:09 18
US
Mode 7: RI mode
Reception Information Display
S1 / S6
- 08-25 23.9°C
C L
1
US
Mode 8: CL mode
Comparison Level Adjustment
S1 / S6


- 1 23.9°C
- R T
23:05
US
Mode 9: RT mode
Reception Time Setting
S1 / S6
- 23.9°C
- R d
00:10
US
Mode 10: RD mode
Reception Duration
Setting
S1 / S6
- 23.9°C
- - - - - - - -
C F
US
Mode 11: CF mode
Field Comparison
Setting
S1 / S6
- 23.9°C
- T M
SE L
US
Mode 12: TM mode
Analog Signal Test
Mode
Mode 1
S1 / S6

1.1 Demo Board Brief Outline



1.2 LCD Main Display Layout



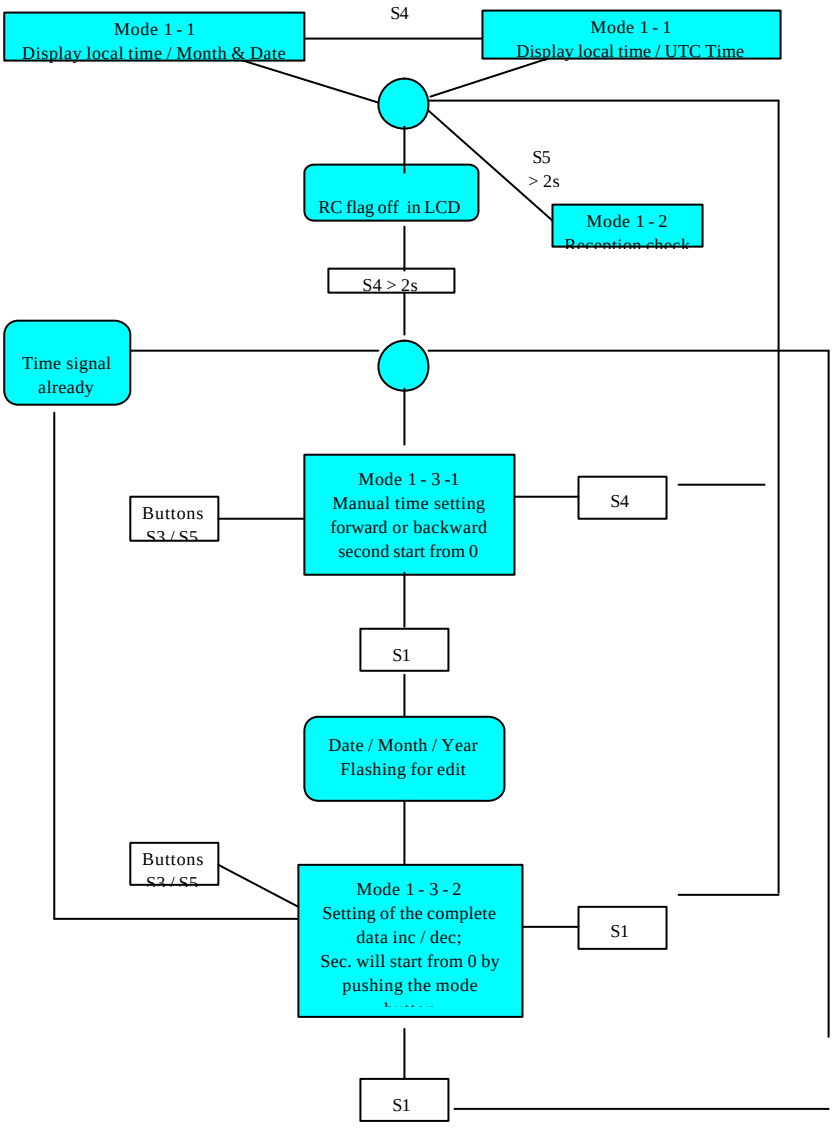
1.3 Mode 1 (display of the local time/ UTC and manual time setting)

Main display Time

Local time display is the standard display.
Time on the display is shown in the 12-hour format: symbols ”PM” for P.M.

Alarm

If the alarm is activated, the alarm indicator will appear on the top left hand corner of LCD.



1 Auxiliary display

The module can be set to display either the date, or UTC time by pressing the “S4” button shortly.

1.4. Mode 2 (setting the alarm – AL mode)

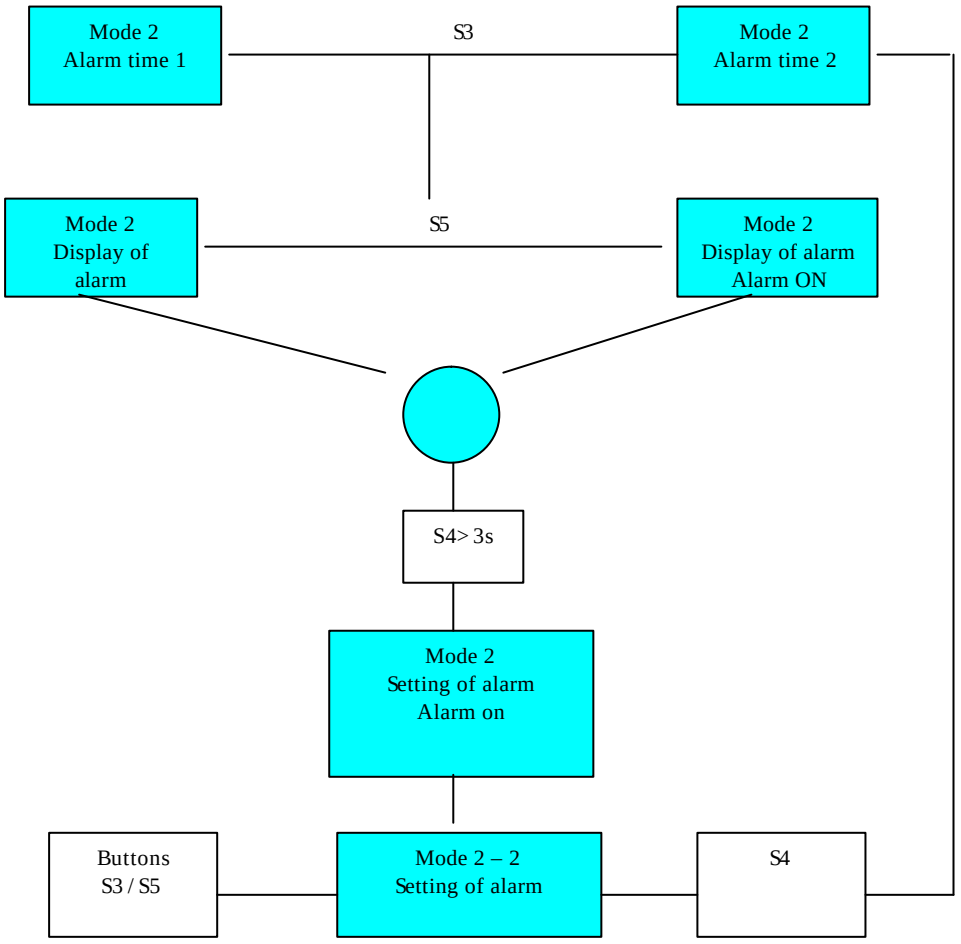
From the main display, press button “S1” once. Display then shows the first alarm time in the main display. To toggle between the 2 alarms, press S3. To set the alarm press and hold button “S4” for 3 seconds. Alarm time will then flash. To set the alarm time press buttons “S3” or “S5” to set the alarm to the desired time. After setting the alarm to the desired time press button “S4” once to confirm setting. After 8 seconds time out, the display will return to the main display.

To turn alarm on/off

Press button “S1” once to display alarm mode. Press button “S5” to turn the alarm on or off. (indicated by alarm indicator bar and “ON” or “OFF” display above minute display)

To stop alarm beeping

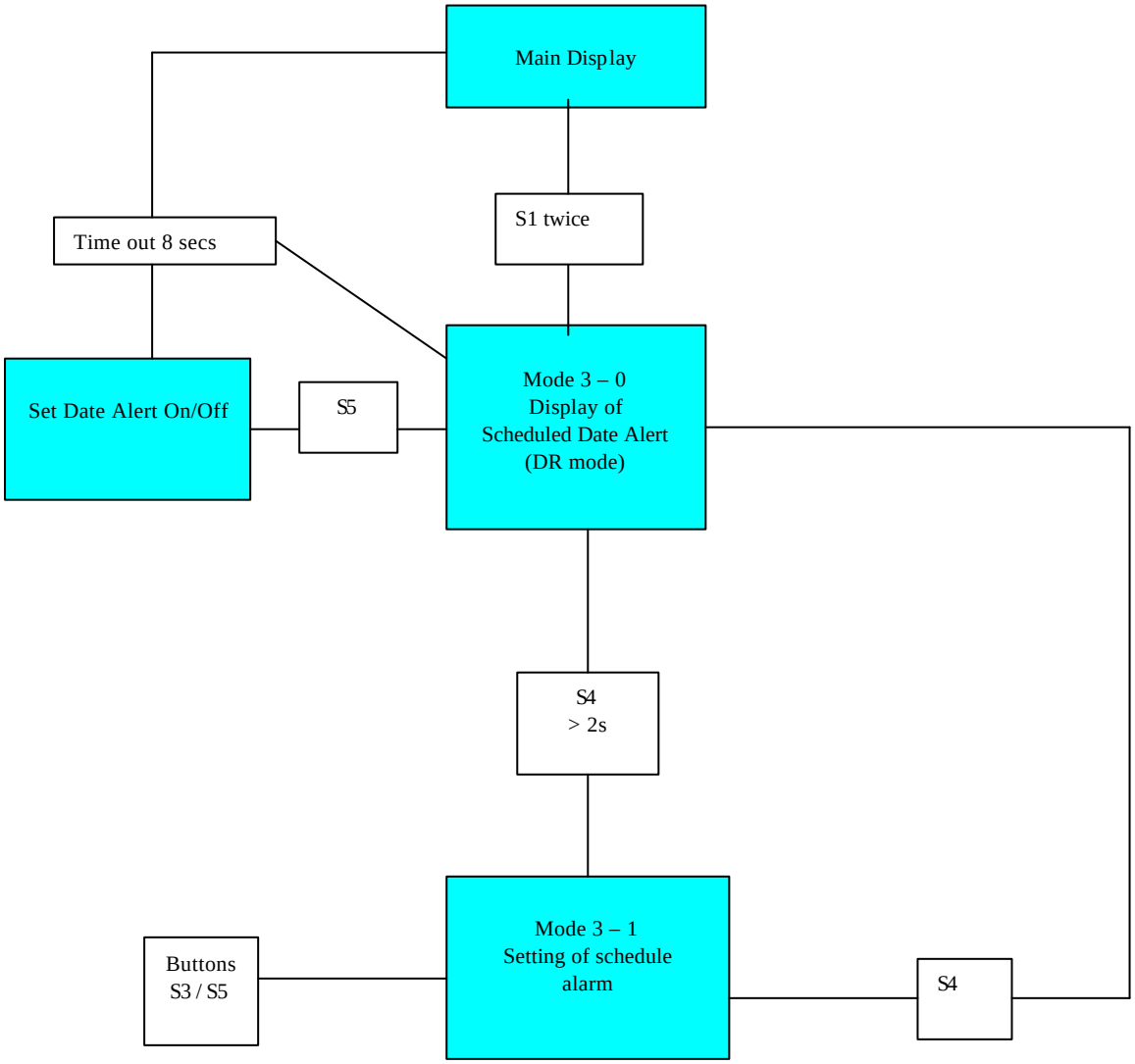
Pressing button S2 while the alarm is beeping puts alarm into snooze mode, alarm will be turned on again after 15 minutes. Pressing any other button while the alarm is beeping will stop the alarm.



1.5 Mode 3 (setting the Date Alert – DR mode)

From the main display press button “S1” twice. Display then shows the date in MM/DD format. To set the Date Alert press and hold button “S4” for 3 seconds. Date will then flash. To set the Date Alert press buttons “S3” or “S5” to set the alert to the desired date. After setting the Date Alert to the desired date press button “S4” once, and LCD will return to main display. In order to activate the date alert for the set date, the S5 button has to be toggled ON, indicated by the “ON” display above the minute display and on the date alert indicator bar.

***The Date Alert is a silent alarm that flashes the date alert indicator on the display on the set day, it continues to flash the entire day unless the user goes into the Date alert mode and sets the alert off.**

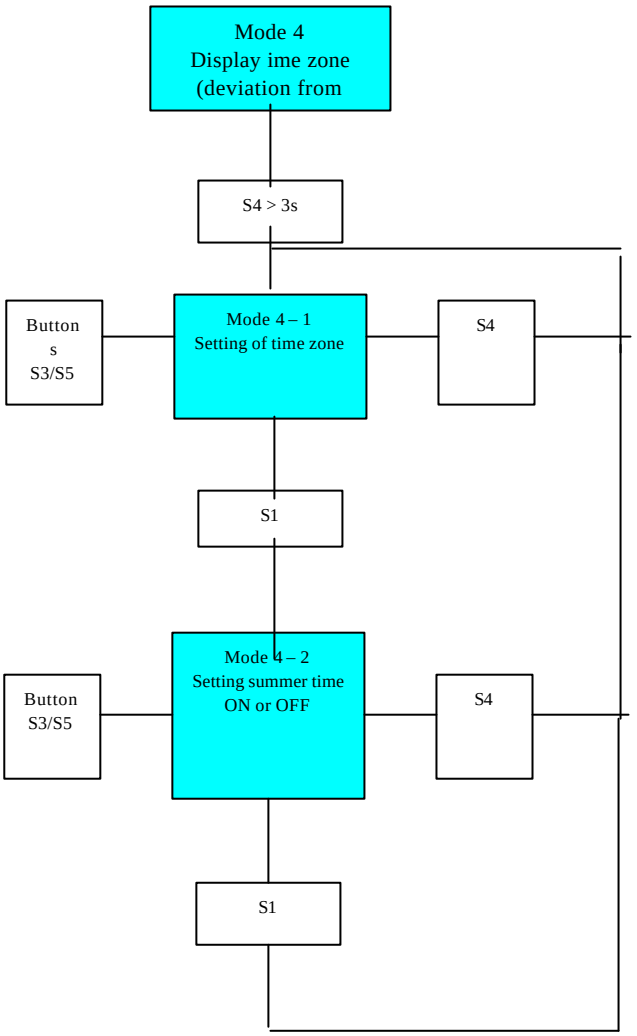


1.6 Mode 4 (setting the Time Zone – ZO mode)

Upon reset, the application will be set default to USA Eastern Time Zone. All time deviation is shown in the auxiliary display according to UTC time. For instance, Eastern time zone is shown as “-5h”. The four US time zones are indicated on the left hand side of the world display, and are abbreviated using “P” for Pacific, “M” for MOUNTAIN; “C” for Central, and “E” for Eastern.

Changing the time zone

From the main display press button “S1” three times. Display then shows the time in the main display, and deviation from UTC in auxiliary display. Press and hold button “S4” for 3 seconds. The auxiliary display will begin to flash. To change the time zone press buttons “S3” or “S5” to set the time to the desired time zone. After setting the time zone press button “S4” and the display will return to main display.



Activate/Deactivate DST

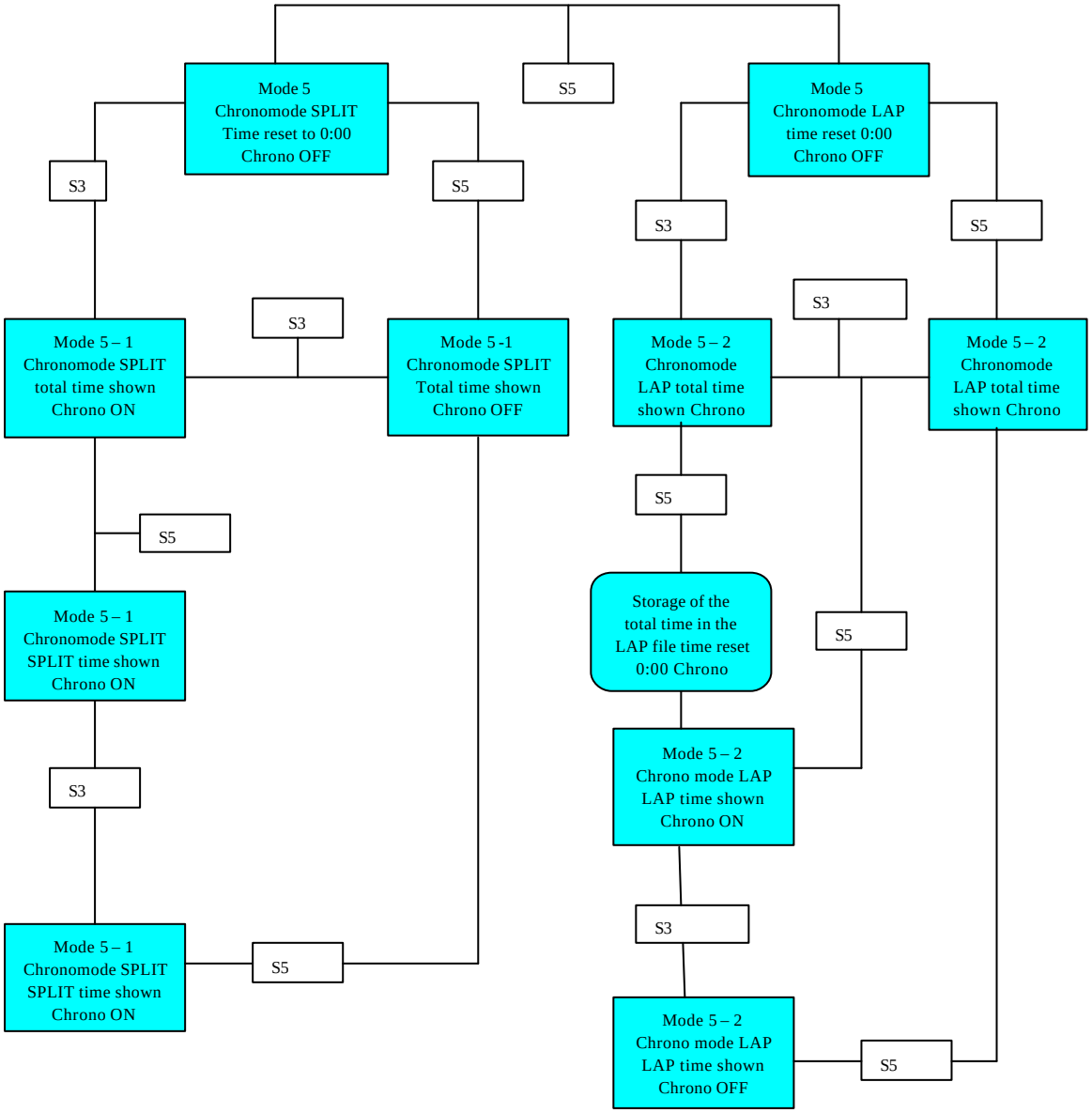
In this mode, the DST adjusted time can be readjusted according to the user’s wish. DST ON will increment hour by 1 if time is originally DST OFF.

1.7 Mode 5 (using the stopwatch feature – SP/LA mode)

The stopwatch operates in three modes: Elapsed Time, Split Time, or Lap Time. Seconds are displayed in the main display, and the 1/100 seconds in the auxiliary display.

Using the stopwatch

From the main display press button “S1” four times. Display then shows the stopwatch display which indicates “0:00:00”.
To select Split Time or Lap Time press button “S5” while in stopwatch mode. Elapsed Time is available in both modes.



Elapsed Time
Press button “S3” to start the stopwatch. Press button “S3” to stop the stopwatch. Press button “S5” to clear the screen to all zeros.
*NOTE: stopwatch will continue to run even if the mode is switched. Stopwatch should be stopped and cleared before switching back to other modes.

Split Time
Press button “S3” to start the stopwatch. Press button “S5” when the first finisher comes in or the first time is up. Read time. Press button “S3” when 2nd finisher comes in or the second and final time is up. Press button “S5” to view time of second finisher, or second time. Press button “S5” again to clear the screen to all zeros.

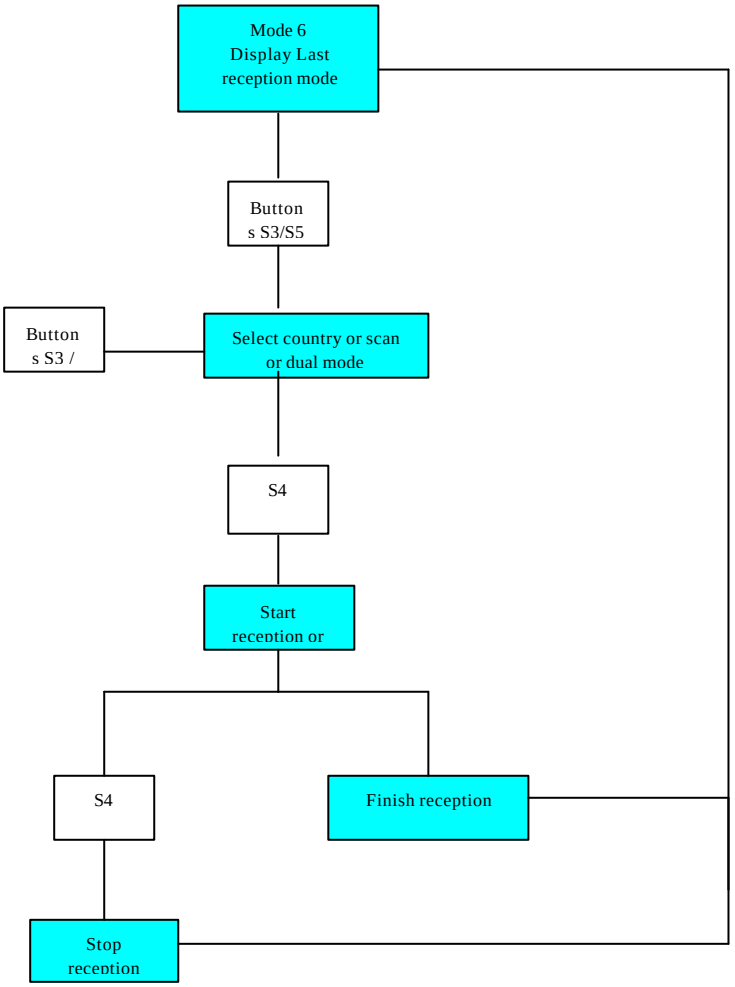
Lap Time
Press button “S3” to start the stopwatch. Press button “S5” to stop first lap and read out results. The stopwatch continues to keep time internally. Press button “S5” again for 2nd lap read-out. Stopwatch will continue to run internally. (You can repeat the above steps as many times as desired.) Press button “S3” to stop watch. Press button “S5” to clear screen to all zeros.

1.8 Mode 6 (using the reception check feature – RX mode)

The demo operates in four countries: Japan (J4 / J6), USA (US), Germany (DF) and UK (EN). The countries can be set by the user for dedicated country reception, Japan dual frequency automatic reception or scanning for country. .

Using the reception check

From the main display press button “S1” five times. “SCAN “ or “DUAL” or “SEL” and “RX” at the top is then displayed on the LCD. To select between different countries or to go to SCAN or DUAL mode, press button “S3” or “S5” while in reception check mode. Display then shows SEL and the selected country symbol on the right hand side of the LCD. .
Press “S4” to start reception or to start scanning if SCAN/DUAL is chosen.



SCAN Mode

The purpose of scan mode is to show the algorithm of scanning through all the possibilities of radio control signal in the event of a universal reception application. In the scanning mode, the demo application scans according to the following algorithm:

		Receiver action	LCD display
set	DCF		“D” blinking; Transmitter blinking; BSI indicator reacting
wait 30 sec			
	if DCF recognised	Start reception in DCF	“D” set on; Transmitter blinking; BSI indicator reacting
	If DCF synchronised	Stop reception	“D” set on Transmitter set on; BSI disappear
	if not DCF recognised	Ignore	
	if BSI relatively good: wait 30sec		
	else:		
set	WWVB+MSF+JJY60		“US”, “GB” & “J6” blinking together; Transmitter blinking; BSI indicator reacting
wait 120 sec			
	if WWVB recognised	Start reception in WWVB	“US” set on; Transmitter blinking; BSI indicator reacting
	If WWVB synchronised	Stop reception	“US” set on; Transmitter set on; BSI disappear
	if MSF recognised	goto MSF	“GB” set on; Transmitter blinking; BSI indicator reacting
	If MSF synchronised	Stop reception	“GB” set on; Transmitter set on; BSI disappear
	if JJY60 recognised	goto JJY60	“J6” set on; Transmitter blinking; BSI indicator reacting
	If JJY60 synchronised	Stop reception	“J6” set on; Transmitter set on; BSI disappear
	if not above 3 recognised	Ignore	
	if BSI relatively good: wait 120sec		
	else:		

set	JJY40		“J4” blinking; Transmitter blinking; BSI indicator reacting
wait 30 sec			
	if JJY40 recognised	Start reception in JJY40	“J4” set on; Transmitter blinking; BSI indicator reacting
	If JJY40 synchronised	Stop reception	“J4” set on; Transmitter set on; BSI indicator disappear
	if not JJY40 recognised	Ignore	
	If BSI relatively good: wait 30sec		
	else:		
set	JJY60		“J6” blinking; Transmitter blinking; BSI indicator reacting
wait 120 sec			
	if JJY60 recognised	Start reception in JJY60	“J6” set on; Transmitter blinking; BSI indicator reacting
	If JJY60 synchronised	Stop reception	“J6” set on; Transmitter set on; BSI indicator disappear
	if not JJY60 recognised	Ignore	
	if BSI relatively good: wait 120sec		
	else:		
set	MSF		“GB” blinking; Transmitter blinking; BSI indicator reacting
wait 30 sec			
	if MSF recognised	Start reception in MSF	“GB” set on; Transmitter blinking; BSI indicator reacting
	If MSF synchronised	Stop reception	“GB” shown in dot matrix; Transmitter set on; BSI indicator disappear
	if not MSF recognised	Ignore	
	if BSI relatively good: wait 30sec		
	else:	Stop	Show last recognized signal; Transmitter and all waves off ;

DUAL Mode

Dual mode is designed to specifically activate reception in Japan for the dual frequency JJY40 and JJY60. The algorithm used below makes use of the protocol recognition intelligence inside CME8000 to search for the stronger signal in the area. However, when both signals are so weak that both cannot be recognized, a final opportunity to receive for a longer period is given to JJY60 due to its stronger signal-to-noise behaviour in general.

		Receiver action	Display
set	JJY60		"J6" blinking; Transmitter blinking; BSI indicator reacting
wait 60 sec			
	if JJY60 recognised	Start reception in JJY60	"J6" set on; Transmitter blinking; BSI indicator reacting
	If JJY60 synchronised	Stop reception	"J6" set on; Transmitter set on; BSI indicator disappear
	if not JJY60 recognised	Ignore	
	else:		
set	JJY40		"J4" blinking; Transmitter blinking; BSI indicator reacting
wait 60 sec			
	if JJY40 recognised	Start reception in JJY40	"J4" set on; Transmitter blinking; BSI indicator reacting
	If JJY40 synchronised	Stop reception	"J4" set on; Transmitter set on; BSI indicator disappear
	if not JJY40 recognised	Ignore	
	else:		
set	JJY60		"J6" blinking; Transmitter blinking; BSI indicator reacting
wait 60 sec			
	if JJY60 recognised	Start reception in JJY60	"J6" set on; Transmitter blinking; BSI indicator reacting
	If JJY60 synchronised	Stop reception	"J6" set on; Transmitter set on; BSI indicator disappear
	if not JJY60 recognised	Ignore	
	else:		
set	JJY40		"J4" blinking; Transmitter blinking; BSI indicator reacting

		Receiver action	Display
wait 60 sec			
	if JJY40 recognised	Start reception in JJY40	"J4" set on; Transmitter blinking; BSI indicator reacting
	If JJY40 synchronised	Stop reception	"J4" set on; Transmitter set on; BSI indicator disappear
	if not JJY40 recognised	Ignore	
	else:		
set	JJY60		
	Start reception in JJY60 for the set reception duration		

In any reception mode, after reception is activated, both the country symbol and the radio tower will flash. When the protocol is being identified, the country symbol will stop flashing and set on, the radio tower will continue flashing as it then starts to verify and synchronize to the radio control time. Once all verification and comparisons are completed successfully, the radio tower will be set on all the time (until the next reception). If synchronization and verification is terminated due to unsuccessful reception, the radio tower will be set off (until the next reception).

1.9 Mode 7 (Reception Information display – RI mode)

This mode (indicated by "RI" on the display) shows information relevant to the last successful reception. The centre digits show the local time at which the last successful synchronisation of time takes place. The upper digits show the duration it took from the start of reception till successful reception in minutes followed by seconds.

This mode is only for information display and therefore has no editing or adjustment functions.

1.10 Mode 8 (comparison level adjustment – CL mode)

Due to different requirements in the degree of certainty in the accuracy of the synchronised time, three different levels of comparison is pre-programmed into the application. In this mode, it is allowed to change between the 3 levels of comparison. User can by themselves select the most optimum setting for themselves during reception.

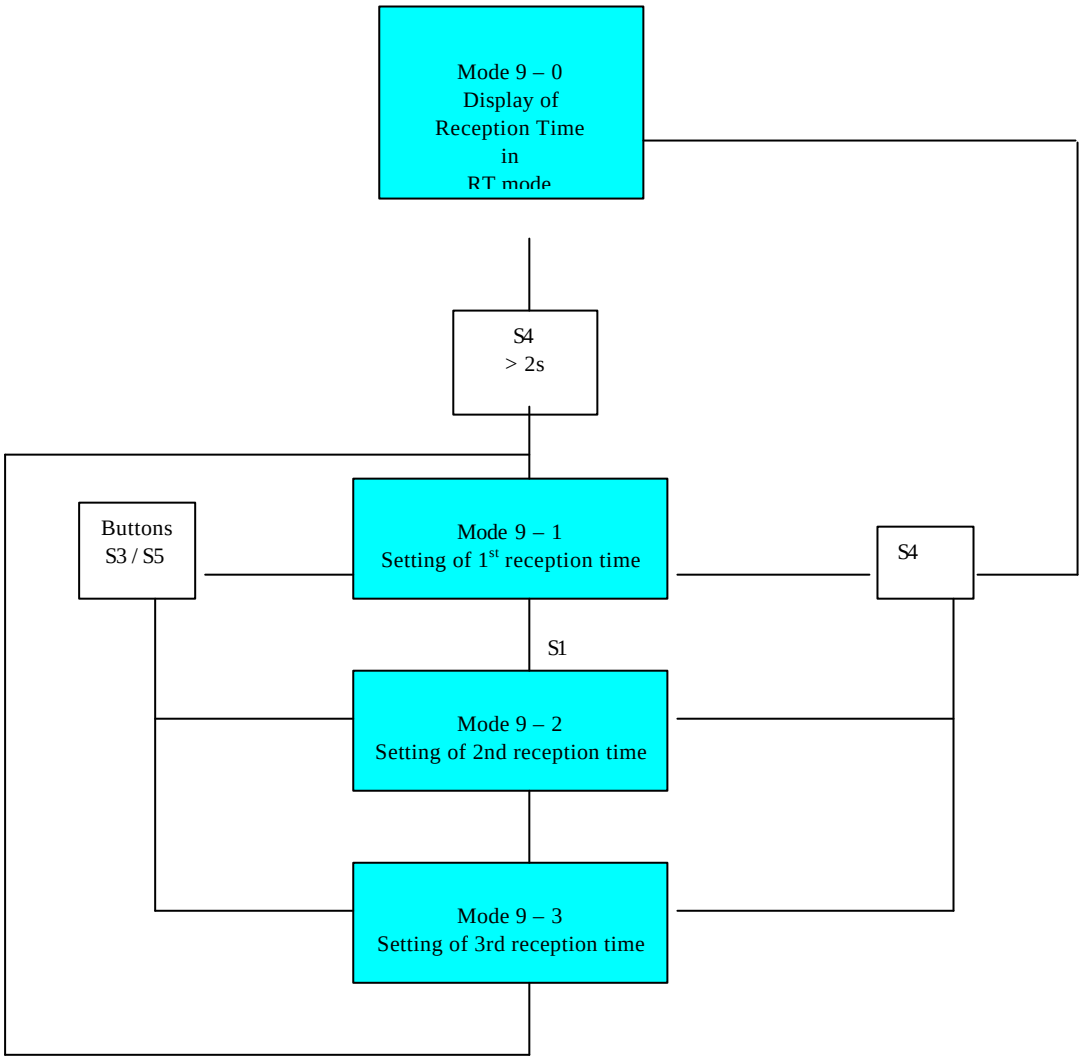
To adjust the comparison level, press S4 for more than 2 seconds until the number on the display starts to flash. Then by using button S3 or S5, the comparison level can be toggled between 1,2 and 3. To confirm setting, press S4 again.

A note of reminder: the level of accuracy is a trade off with the time required for complete synchronization. The higher the level of accuracy required, the longer the duration of reception. A rough portrayal of this phenomenon is shown below:

Comparison Level	Minimum reception duration (no scan) without reference time
1	2 minutes
2	3 minutes
3	4 minutes

1.11 Mode 9 (Reception Time setting – RT mode)

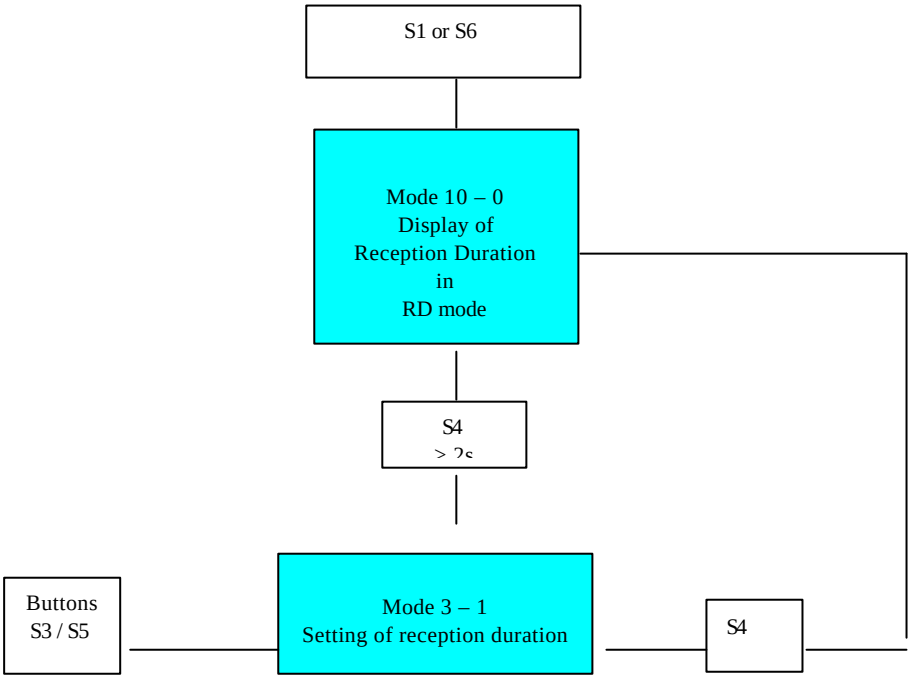
In order to increase the flexibility of users to evaluate the reception capability and to choose an optimum reception algorithm, 3 programmable auto reception times are available. At the set time, the demo will go into reception mode at the last received protocol automatically for a maximum duration set by the Reception Duration Menu (default is 10 minutes). If only 1 reception time is required, then the user will have to set the 3 programmable reception times to the same time setting. The button S1 is used to toggle between the 3 different reception times while the keys S3 and S5 are used to adjust the time.



1.12 Mode 10 (Reception Duration setting – RD mode)

The reception duration mode can be used to define the maximum duration that the user wants to spend looking for the radio control signal. This duration can be manually set within the range 1 min to 24 hr 00 mins. Note however some settings does not make sense at all, for example setting 1 minute reception with no reference time will never receive a signal. The default setting after reset is 10 minutes. If duration is adjusted to 00:00, this stands for 24 hours reception duration.

This mode can be entered by pressing either S1 or S6 until the display show “Rd” . In this menu, press S4 > 2secs and the digits will start to flash. The duration can then be adjusted via the S3 and S5 buttons. Pressing S3 or S5 for more than 8 secs will fast adjust the duration by jumping from minute to hour adjustment.



1.13 Mode 11 (Field Comparison setting – CF mode)

Some applications does not necessarily require all information within the radio control time data stream. For example, for a 2-hand analog watch, only the hour and minute information is useful. Therefore we also allow the customer to set for themselves which data field to verify inside the software.

This CF mode can be reached by pressing either the S1 or S6 button. By pressing the button S4 for > 2seconds, the bars on the top of the LCD will start to flash. The upper bar acts as a cursor to indicate which of the seven data fields you want to disable or enable. Counting from right to left, the lower bars represent : Minute, Hour, Date of the month, Month, Year, Day of the week, Special bits respectively. The special bits that will be compared for each protocol are listed below. If the first bar from the left is activated, this means all special bits listed below for that particular protocol will be compared. The user cannot choose between the individual special bits.

DCF : Summer and winter time bits

Bit16	Bit17	Bit18	Bit19

MSF : Summer time bits

×	×	Bit53	Bit58

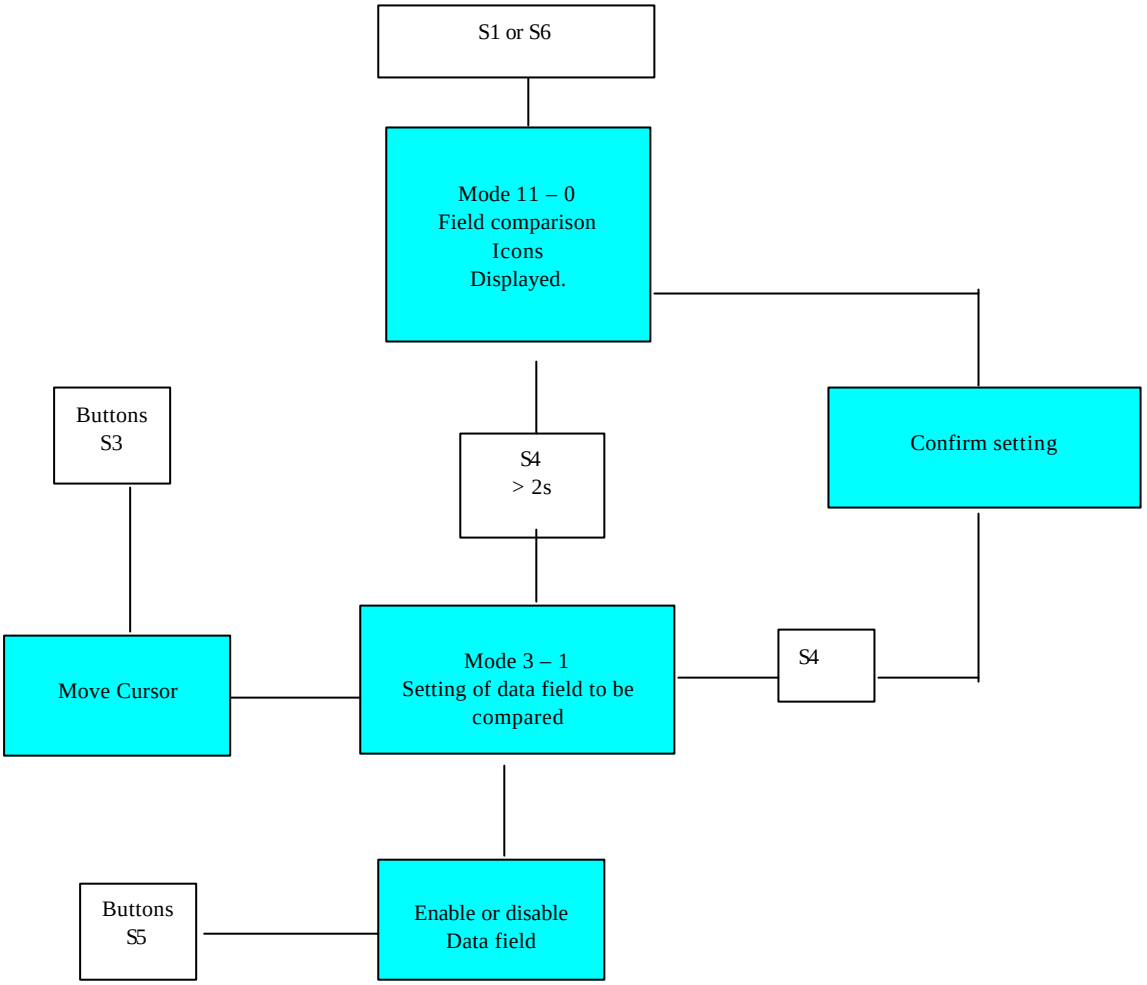
WWVB : Leap year (55), leap second (56), DST (57 & 58)

Bit55	Bit56	Bit57	Bit58

JJY : DST (38 & 40), leap second (54 & 55)

Bit54	Bit55	Bit38	Bit40

The button S3 moves the cursor, while the button S5 disables or enables the data field represented by the lower bars. To confirm, press S4 and the bars will stop flashing.



1.14 Mode 12 (Analog Signal Test mode for CME8000 – TM mode)

The demo operates in four countries: Japan (J4 / J6), USA (US), Germany (DF) and UK (EN). It is therefore sometimes useful for the designers to see what the analog output of the receiver IC shows, especially when it comes to the issue of noise and sensitivity. The Analog Test Mode is available to check the IC for the output of the analog portion of the CME8000 IC. .This analog output can be probed with an oscilloscope at the TEST pin on the demo board.

Monitoring the analog signal

Press S1 or S6 until “TM” followed below by “SCAN “, “DUAL” or “SEL” is displayed on the LCD. To select between different signals or to go to scanning routine, press button “S3” or “S5”. Display then shows SEL and the selected country symbol on the right hand side of the LCD for dedicated country selection. For SCAN or DUAL mode in test mode, the routine of scanning is the same as in reception check, only that the time spent in each signal is limited to 30 seconds for oscilloscope monitoring purposes. Press “S4” in order to start monitoring analog output. When test activated, the “TM” logo will start blinking. There is no time out to this function if dedicated country is selected. In SCAN and DUAL mode, the output will stop once the whole scanning routine is completed. The user has to press “S4” again in order to stop the test and return to the main menu.

Note that when test mode is activated, any running reception is disabled. It is not possible also here to leave this menu until the test is terminated by pressing S4.