CMT MANUAL

4.2 USER MANUAL – NMC IRRIGATION

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Netafim South Africa

4.2.0 INTRODUCTION

	This section of the CMT manual is a user's manual for the software of both the NMC Pro and the NMC Junior. It is written as though the NMC Pro is the product software being used. The NMC Junior uses the same software format as the NMC Pro; however the software is constrained by the limitations of the NMC Junior's hardware. Where the NMC Junior differs, these limitations or differences are explained in a 'JR' box as follows beneath.

	This box explains the differences or limitations of the NMC Junior as they occur in the manual.

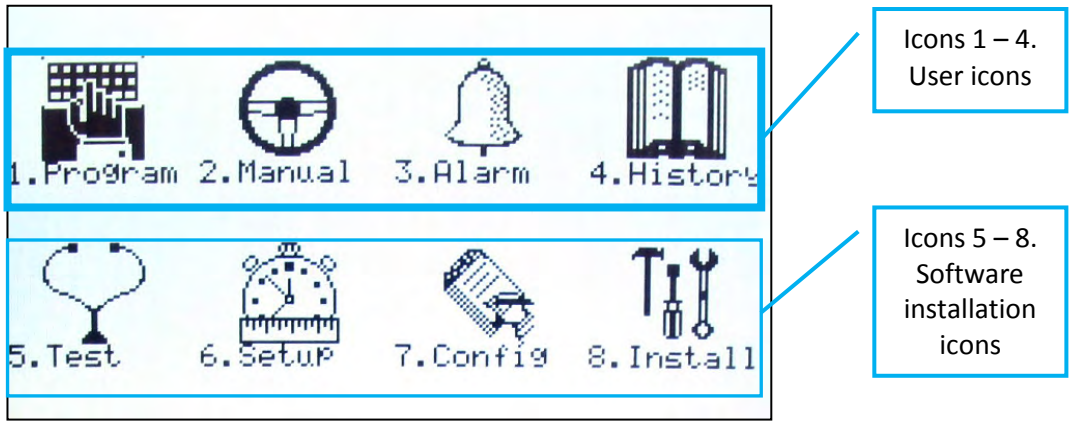
Netafim's NMC Pro is a top of the line irrigation controller with the most updated technology. It manages irrigation, fertigation, misting and cooling systems. This section of the CMT Manual describes the NMC Pro programming and operating procedures. Prior to using the controller in your facility, you will need to complete the controller's hardware installation (see section *2.2 Installation – Hardware – NMC 64/Pro* as well as its software installation (see section *3.2 Installation – Software – NMC Irrigation*).

	Once the controller is installed, configured, set-up and tested, all relevant menus will be available for use. All values indicated in this manual are in SI (metric) units.

In everyday use, the user of the controller will only use the first four icons of the main screen (Icons 1 to 4). However, prior to using them, the installation of the software must be complete. This software installation is handled using the second set of 4 icons (Icons 5 to 8).

	This section of the CMT Manual only deals with Icons 1 – 4. (See section *3.2 Installation – Software – NMC Irrigation* for Icons 5 - 8).

FIGURE 1. MAIN MENU SCREEN – FIRST FOUR ICONS AND SECOND FOUR ICONS



4.2.0.1 GENERAL DESCRIPTION

- The NMC Pro is a modular flexible irrigation controller with many customizable features:
  - Output card options for 24VAC and / or dry contact
  - Input cards for digital and / or analogue sensors
  - Sensors for EC, pH, temperature, humidity, weather station, etc.
  - Local or remote communication to PC
- The new and advanced large LCD graphic screen (16x40 lines) makes the NMC Pro user friendly and easy to operate and program.
- The NMC Pro is modular and can be expanded by adding additional I/O cards.

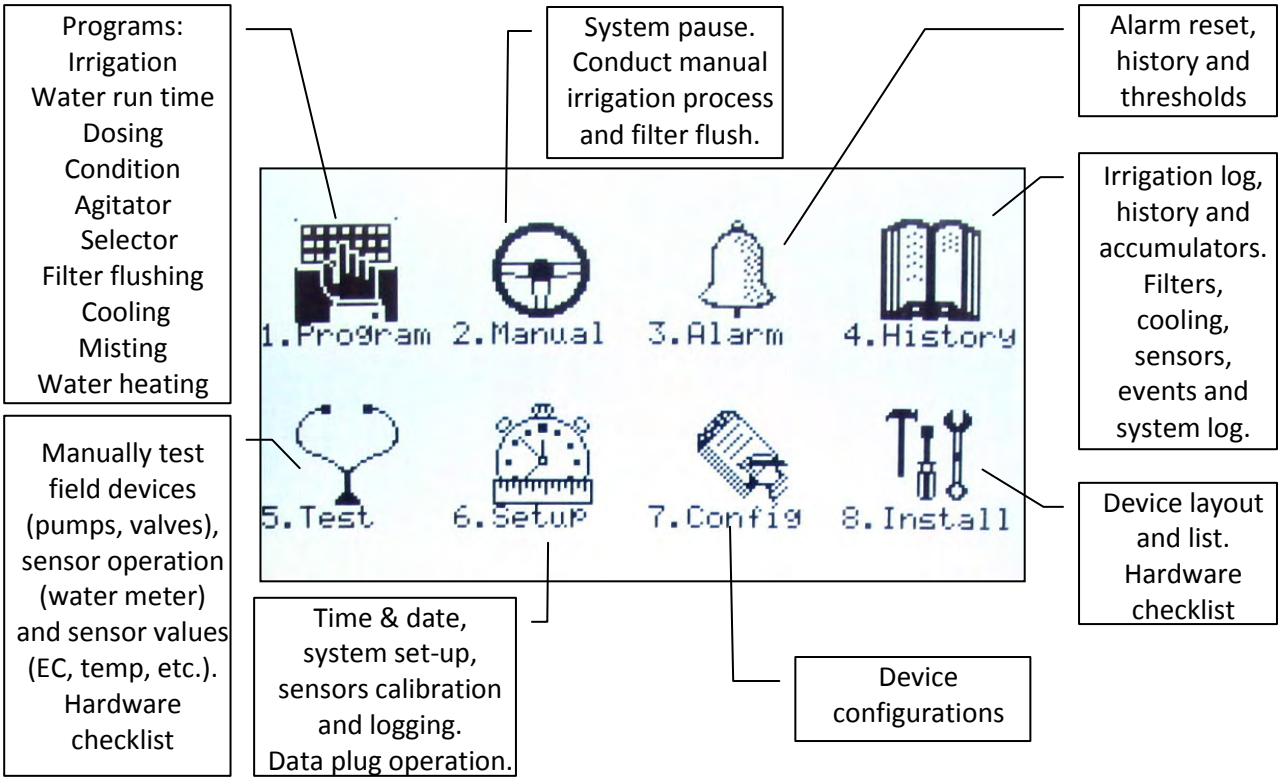
4.2.0.2 MAIN FEATURES

- Large graphics - LCD 16x40 characters
- 15 Irrigation programs
- 60 Floating runtime programs (irrigation water programs)
- Flow control (high and low flow, uncontrolled water flow)
- Up to 8 dosing channels (optionally with dosing meters)
- Fertigation by quantity, time, ratio (l/m³) and EC/pH
- Filter flushing (up to 24 filters)
- Cooling / humidification program
- Misting program
- History of water and fertigation quantities
- Fault and event list registration
- PC communication and HMI
- Outputs & inputs test
- Plug & play hardware with automatic checklist
- Data plug for backing up settings and setup (standard)

4.2.0.3 MAIN MENU SCREEN

Press the **MENU** key a few times until you reach the **MAIN MENU** screen.
The **MAIN MENU** screen contains eight icons. Use the arrow keys to navigate and select icons. The selected icon will be highlighted and can be used to display the menu screen by pressing the **ENTER** button.
Alternatively, you can press the number indicated next to each icon.
For example, press the '3' key to go directly to the **Alarm Menu**.
To go back to the **MAIN MENU** screen simply press **MENU** button.

FIGURE 2. MAIN MENU SCREEN – INDIVIDUAL ICONS



4.2.0.4 KEYPAD

FIGURE 3 KEYPAD – NUMERIC – WITH MAIN MENU

FIGURE 4 KEYPAD – ALPHANUMERIC

TABLE 1 : KEYPAD BUTTONS

Key	Description
Help	To access help screens and graphs.
Menu (Back)	To access main menu, also acts as “ESC” and “BACK” key.
Delete	To erase typing mistakes.
Arrow	To scroll up, down, left and right to select menus or values.
‘+/-‘	To toggle between positive and negative values, mark check boxes for option selection and in history screen used to toggle between quantity and time format.
‘.’	The ‘.’ key enters a decimal point.
Numbers	To change a value, press ENTER to confirm. Also used as shortcut to menu screen selection.
Enter	To enter menu or submenu and to confirm a value change.

TABLE 2 : ALPHABET CHARACTERS ALLOCATED TO KEYPAD BUTTONS

Key	Characters
1	‘ ’
2	A B C
3	D E F
4	G H I
5	J K L
6	M N O
7	P Q R S
8	T U V
9	W X Y Z
0	Space
‘.’	. , ! ? $
‘+/-‘	+ - < > #

Both the numeric and the alphanumeric keyboards feature the same alphabet characters. These characters automatically come into use when entering text using a menu where text is required.

4.2.0.5 NMC PRO GENERIC OPERATION GUIDELINES

The NMC Pro operation is simple and intuitive. To change specific settings, navigate the cursor (flashing underline mark) using the arrows until it is under the relevant setting. Change settings according to type of field (value, list of options, etc.) as follows:

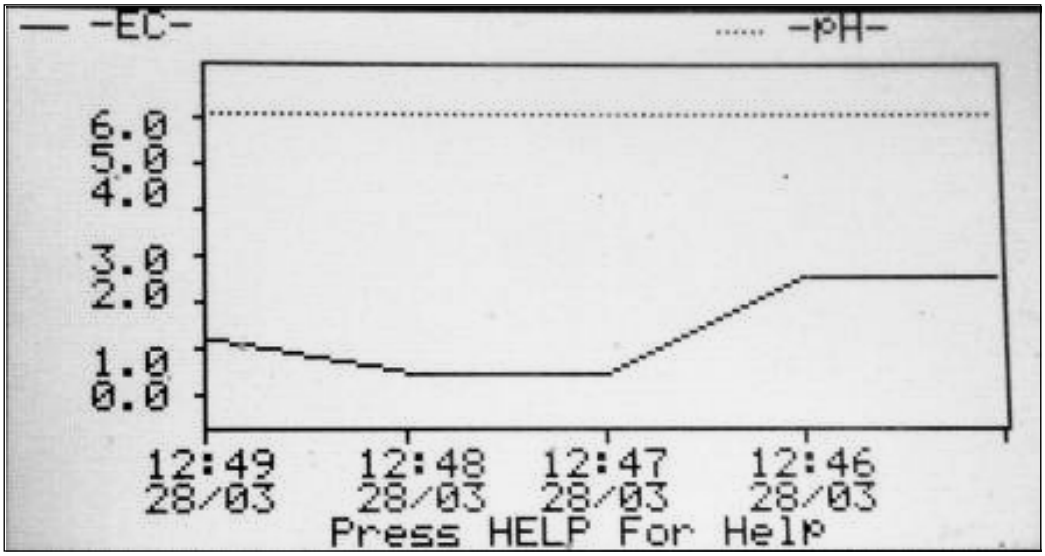
- **Value** – use the numeric keys to change the value and press **ENTER** to confirm.
- **Options List** - press **ENTER** to open the options list of the screen you are in. Use the arrow keys to navigate the cursor to the right field and press **ENTER** again to confirm.
- **Time (hh:mm:ss)** - set hours, press the **ENTER** key to move to the minutes, set the minutes, press the **ENTER** again to move to the seconds.
- **Factors** - use the left and right arrows to change the factor up and down respectively.
- **Selection** – use the **+/-** key to select or un-select options.
- **Delete** - to erase typing mistakes.

NB	Remember to confirm changes by pressing the ENTER key or the down-arrow. If you don’t confirm, the new value will not be saved and the controller will revert to the previous value.

4.2.0.6 VIEWING GRAPHS ON THE NMC PRO

The NMC Pro has a graphical LCD screen, which can display graphs. A maximum number of 3 sensors data can be displayed per graph by selecting the relevant sensors from the sensor log. The **4.11 SENSOR LOG** * is a sub menu that can be accessed from the **4.History** icon. After accessing the sensor log press the **HELP** key and select **Graph.** Move between the sensors data with the up and down arrow keys and select the data to be displayed (3 sensors maximum) on the graph with the **+/-** key. Press **MENU** to display graph. Press **MENU** twice to exit graph end return to **4.11 SENSOR LOG***.

FIGURE 5. EXAMPLE OF HOW A GRAPH IS DISPLAYED ON THE SCREEN



JR	* This sub menu is indexed as 4.10 SENSOR LOG in the NMC Junior. The available sensors are fixed as average temperature, humidity, EC and pH. A maximum of three sensors can be displayed per graph

4.2.0.7 HOT SCREENS

The NMC Pro software includes nine hot screens that allow you quick access to information of current and future processes as well as general conditions.

Continual pressing of the MENU key from anywhere will eventually take you to the MAIN MENU screen in FIGURE 2. Once in the MAIN MENU screen, any further pressing of the MENU key will toggle between the MAIN MENU screen and the default HOT SCREEN. The default HOT SCREEN is set by Netafim as HOT SCREEN 1 when the controller is dispatched. The default HOT SCREEN may be changed by the user if desired. (Go to sub menu 6.2 SYSTEM SETUP which can be accessed from the 6.SETUP icon. See Section 3.2.6.2 INSTALLATION – SOFTWARE – NMC IRRIGATION for further details).

The HOT SCREENS are accessed once you are in the default HOT SCREEN by pressing one of the numeric keys (0 to 8).

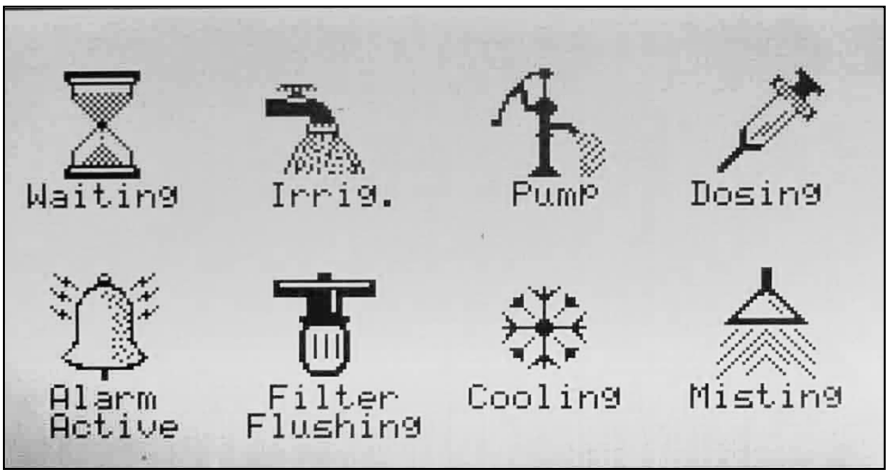
JR	There are only seven hot screens in the NMC Junior. They are accessed by pressing keys 0 to 6 when you are in the default hot screen.

EXAMPLES AND EXPLANATION OF HOT SCREENS AVAILABLE:

HOT SCREEN 0 – ICONS OF ACTIVE PROCESSES:

NB	Hot screen icons are only displayed when processes are active.

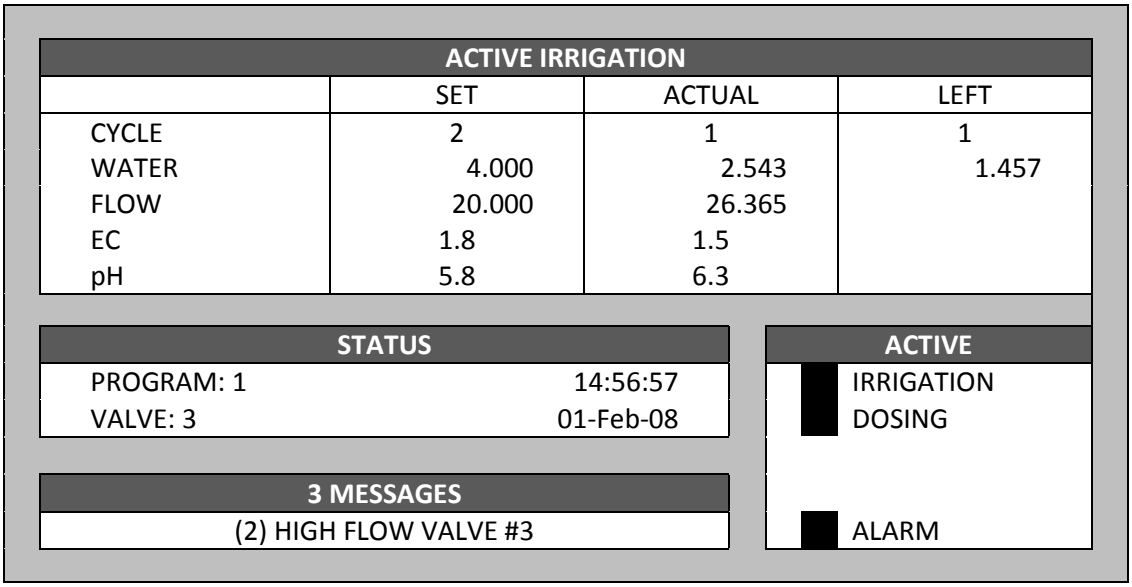
FIGURE 6. HOT SCREEN 0 - DISPLAY OF HOT SCREEN ICONS



- **Waiting** – The controller is idle, no processes are taking place.
- **Irrig**. – Irrigation process is active.
- **Pump** – One or more of the pumps are active.
- **Dosing** – Dosing process is active.
- **Alarm Active** – One or more alarms are active.
- **Filter Flushing** – The filter flushing process is active.
- **Cooling** – The cooling process is active, meaning its conditions are met. This doesn't necessarily mean a cooling valve is opened.
- **Misting** – The misting process is active, meaning one or more misting valves are open.

HOT SCREEN 1 – SUMMARY OF ACTIVE PROCESSES, IRRIGATION PROGRAMS, IMPORTANT MESSAGES AND TIME & DATE:

FIGURE 7. HOT SCREEN 1 - DISPLAY OF ACTIVE IRRIGATION



- **ACTIVE IRRIGATION** – Displays **SET**, **ACTUAL** (given) and **LEFT** (outstanding) irrigation cycle data:
    - **CYCLE** – Displays how many cycles are set, which cycle is currently active and how many are remaining.
    - **WATER (m^3 / HH:MM:SS)** – Displays the set water quantity/time, actual water quantity/time and left water quantity/time.
    - **FLOW (m^3/h)** - Displays the set (nominal) flow rate and actual (measured) flow rate.
    - **EC** – Displays the set (required) EC and the actual (measured) EC values.
    - **pH** - Displays the set (required) pH and the actual (measured) pH values.

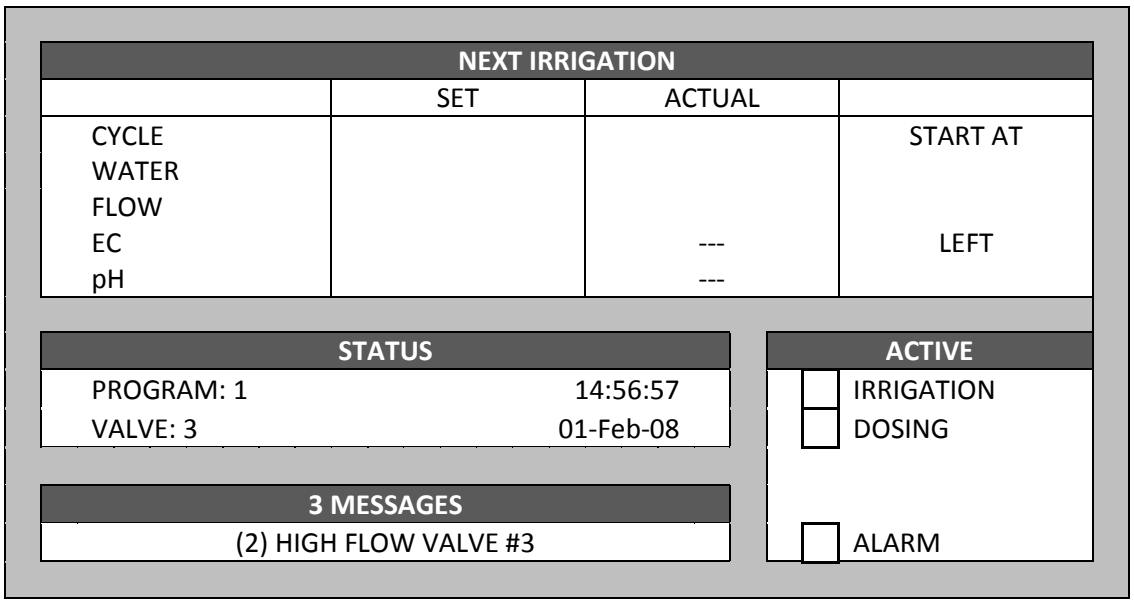
NB	For set EC and pH "not set" indicates no dosing or volumetric dosing.

- **STATUS** – Displays the active or next program and abbreviated program trigger (Radiation, Manual, Uncompleted Program, etc.). The next line displays the active or next valve (if more than two valves are active, the first two will be displayed with a + mark next to the second to indicate that there are more valves operative). The current time and date is also displayed.

JR	If more than three valves are active, the NMC Junior will display the first three.

- **MESSAGES** – Displays active alarms by flashing and scrolling alarm messages.
- **ACTIVE** – Indicates active processes by black squares to the left of listed processes.

FIGURE 8. HOT SCREEN 1 - DISPLAY OF NEXT IRRIGATION



When irrigation is not taking place, this screen will display as NEXT IRRIGATION

HOT SCREEN 2 – ACTIVE IRRIGATION AND DOSING STATUS:

NB	Hot screen 2 is only relevant during an active irrigation process.

FIGURE 9. HOT SCREEN 2 - DISPLAY OF IRRIGATION STATUS

IRRIGATION PROCESS			
Prog: 1	Valve: 3	Time:	14:56:57

	Set	Actual	Flow	Valve
Water	4.000	2.543	26.365	ON
Chan. 1	4.50	11.44	300.000	ON
Chan. 2	5.50	13.99	300.000	ON
Chan. 3	5.00	12.72	100.000	OFF

- **IRRIGATION PROCESS** – Active program number preceded by abbreviated program trigger (Manual, Radiation, Uncompleted Program, etc.), active valve number (if two or more valves are active, the first valve number will be displayed with a + mark next to it) and current time.
  - **Functions** (devices, left column) – Active devices for the current irrigation.
  - **Set** - Total quantity/time to be given during the current irrigation.
  - **Actual** – Actual quantity/time already given.
  - **Flow** – Actual (measured) flow rate of the device.

NB	All irrigation flow rates indicated will be in m^3/h (cubic metres per hour) and dosing flow rates will be in ℓ/h (litres per hour).

  - **Valve** – Current status (on / off) of the valve and/or dosing channel.

JR	The display in the NMC Junior is limited to its hardware constraints.

HOT SCREEN 3 – DETAILED INFORMATION REGARDING ALL OF THE IRRIGATION PROGRAMS:

NB	To navigate between the irrigation programs use the left & right arrow keys**.**

FIGURE 10. HOT SCREEN 3 - DISPLAY OF IRRIGATION PROGRAM STATUS – NMC PRO

PROGRAM STATUS		
Program: 2	01-Feb-08	14:56:57

Status	Wait
Time - Minimum	00:20
Time - Maximum	01:00
Rad Sum - Measured / Limit	103 / 150
Clock Starts - Given / Set	-- / --
Starts Due To Rad Sum	4
Starts Due To Max Time	1
Total Cycles Given	5
Last Start	14:15:25
Elapsed Time	00:41:32
Next Start	15:15:25

- **PROGRAM STATUS** – Active program number, current date and time.
  - **Status:**
    - **End** - All of the irrigation cycles are complete.
    - **Wait** - In between irrigation cycles.
    - **Irrig** - Irrigation cycle is active.
  - **Time - Minimum (hh:mm)** – Minimum time between starts of irrigation cycles.
  - **Time – Maximum (hh:mm)** – Maximum time between starts of irrigation cycles.
  - **Rad Sum (J/cm²) – Measured/Limit:**
  - **Measured** – Measured radiation sum since start of last irrigation cycle.
  - **Limit** – Set radiation sum limit from irrigation program.
  - **Clock Starts – Given/Set:**
  - **Given** – Number of irrigations cycles already performed due to clock starts.
  - **Set** – Number of irrigations cycles for this program to be performed due to clock starts.
  - **Starts Due To Rad Sum** – Number of irrigations cycles performed due to radiation sum.
  - **Starts Due To Max Time** – Number of irrigation cycles performed due to **Time - Maximum**.
  - **Total Cycles Given** – Total number of irrigation cycles already performed.
  - **Last Start (hh:mm:ss)** – Start time of the previous/current irrigation cycle.
  - **Elapsed Time (hh:mm:ss)** – Elapsed time since the start of the last irrigation cycle.
  - **Next Start (hh:mm)** – Start time of next irrigation cycle.

JR	Hot Screen 3 in the NMC Junior is significantly different to the NMC Pro and is described separately below.

FIGURE 11. HOT SCREEN 3 - DISPLAY OF IRRIGATION PROGRAM STATUS – NMC JUNIOR

PROGRAM STATUS			
Date: 29-Oct-08		Time:	14:56:57

Program	1	2	3
Status	End	Wait	Wait
Next Start	---	11:00	13:00
Total Cycle	1	1	1
Act Cycle	1	0	0
Left Cycle	0	1	1
Valve #		1	1
Run Time #	1	1	1
Dosing Prog	1	1	1

JR

Hot Screen 3.

- **PROGRAM STATUS –** Current date and time.
  - **Status** - Cycle status:
    - **End** - All of the cycles are done.
    - **Wait** - In between cycles (Delay Time)**.**
    - **Irrig** - Irrigation is active.
  - **Next Start** - When Status is "Wait" row will show the time for next irrigation.
  - **Total Cycle** - Total number of cycles to be given for the current period.
  - **Act Cycle** - Number of cycles already given for the current period.
  - **Left Cycle** - Remaining number of cycles to be given for the current period.

Example. Program 2 in FIGURE 11 has to perform three cycles. One has already been given and two are remaining.

NB	If the starting time of a future program has already passed, the **Next Start** displays the passed start time while the **Status** displays 'Wait'.

HOT SCREEN 4 – DOSING PROCESS INFORMATION:

NB	This screen is very useful for the setup and checking of the dosing system, Hot Screen 4 is only relevant during an active dosing process.

FIGURE 12. HOT SCREEN 4 - DISPLAY OF DOSING PROCESS – NMC PRO

WATER&FLOW	
Status	Irrig.
Nom.	5.000
Act.	4.942

EC/pH			
	EC	pH	EC.Pre
Target	1.7	5.9	---
Actual	1.7	5.8	---

	Open(%)	Min(%)	Prg(%)	Max(%)
Chan. 1	---	---	---	---
Chan. 2	68	49	70	91
Chan. 3	68	49	70	91

FIGURE 13. HOTSCREEN 4 – DISPLAY OF DOSING PROCESS –NMC JUNIOR

WATER	
Status	Irrig.
Nom. Flow	5.000
Act. Flow	4.942

EC/pH		
	EC	pH
Target	1.7	5.9
Actual	1.7	5.8

	Open(%)	Min(%)	Prg(%)	Max(%)
Chan. 1	---	---	---	---
Chan. 2	68	49	70	91
Chan. 3	68	49	70	91

- **WATER**
  - **Status** - Water status:
    - **Wait** - Irrigation process is not active.
    - **Irrig.** - Irrigation process is active.
  - **Nom. (m^3/h)** - Displays the set (nominal) flow rate.
  - **Act. (m^3/h)** - Displays the actual (measured) flow rate.
- **EC/pH**
  - **Target** – Set (required) EC/pH and EC Pre-control values.
  - **Actual** – (measured) EC/pH and EC Pre-control values.

JR	EC Pre-control is not available in the NMC Junior. See **Error! Reference source not found.**

- **Lower section**
  - **Dosing channels** (left column) – Dosing channels setup for system.
  - **Open(%)** – Actual opening percentage of the dosing channel.
  - **Min(%)** - Minimum allowed opening percentage of the channel.
  - **Prg(%)** – Calculated opening percentage of the channel.
  - **Max(%)** – Maximum allowed opening percentage of the channel.

NB	The **Prg (%)** and **Min/Max (%)** are calculated according to the **1.3 DOSING** program settings, dosing channel flow rate + allowed deviation [High(%) and Low(%)] set in **7.6 DOSING CHANNEL CONFIGURATION**] and actual (measured) water flow. When EC/pH control is active the **Open (%)** will change according to the difference between the set and the actual EC/pH values. If the **Open(%)** is close to the **Min(%)** or **Max (%)** it means that there is a big deviation between the dosing program settings to the actual injection ratio. The **Open (%)** cannot be higher than the **Max (%)** and cannot be lower than the **Min(%)**. If it is identical to one of them, the NMC Pro Controller will not be able to reach the set EC/pH values and the dosing program settings must be rechecked. See Section 5.5 *The Bucket Test*.

HOT SCREEN 5 - FILTER FLUSHING INFORMATION:

FIGURE 14.HOT SCREEN 5 - DISPLAY OF FILTER FLUSHING STATUS

FILTER FLUSHING STATUS	
Item	
Flush Status	OFF
Time to Next Flush	00:00:30
Delta Pressure (Digital)	OFF
Flushing Filter No.	--
Remaining Filters Qty.	0
Delay	00:02
Current Delta Pressure	----

FILTER FLUSHING STATUS

- Item
  - **Flush Status** - Indication of the filter flushing status (on / off / waiting).
  - **Time To Next Flush (hh:mm:ss)** – Remaining time until next filter flushing cycle.

NB	**Time To Next Flush** is only counted when irrigation is active. (Irrigation time not clock time)

  - **Delta Pressure (Digital)** – Digital delta pressure status (on / off).
  - **Flushing Filter No**. – Current filter number being flushed.
  - **Remaining Filters Qty**. – Shows how many filters are still to be flushed.
  - Delay / Flush Time (mm:ss)
    - **Delay** – Countdown delay time between flushing one filter to the next. (Visible when flushing is not in progress)
    - **Flush Time** – Countdown remaining flush time for the filter being currently flushed. (Visible when flushing is in progress)
  - **Current Delta Pressure (bar)** – Measured delta pressure (pressure differential) between inlet pressure sensor (Pin) and outlet pressure sensor (Pout). Active if **P**in and **P**out sensors are configured and connected.
  - **Main Filter Delay (mm:ss)** (Not visible on the screen in **Error! Reference source not found.**) - Dwell time for the main filter valve. When flushing is in progress this value will show the remaining dwell time.

JR	Current Delta Pressure is not available in the NMC Junior. The Main Filter Delay is always visible.

HOT SCREEN 6 - TEMPERATURE AND HUMIDITY SENSOR READINGS:

FIGURE 15. HOT SCREEN 6 - DISPLAY OF TEMERATURE AND HUMIDITY SENSORS READINGS

TEMP & HUMIDITY		
No.	Temp.	Humidity
1	22.8	55.3
2	<NONE>	<NONE>
3	<NONE>	<NONE>
4	<NONE>	<NONE>
5	<NONE>	<NONE>
6	<NONE>	<NONE>
7	<NONE>	<NONE>
8	<NONE>	<NONE>
AVG.	22.8	55.3

TEMP & HUMIDITY

- **No**.
  - Temperature & humidity sensor number (maximum number of 8 sensors per type).

NB	Average reading of all the temperature and humidity sensors connected will be displayed in the last row.

- **Temp. (°C)**
  - Temperature reading from sensors connected.
- **Humidity (%RH)**
  - Humidity reading from sensors connected.

JR	The NMC Junior is limited to 2 temperature sensors and 1 humidity sensor.

HOT SCREEN 7 – WEATHER STATION SENSOR READINGS:

JR	This feature is not available in the NMC Junior.

FIGURE 16. HOT SCREEN 7 - DISPLAY OF WEATHER STATION SENSOR READINGS

WEATHER STATION	
Outside Temperature	28.9°
Outside Humidity	67.3%
Wind Direction	230°
Wind Speed	<NONE>
Radiation	1026 Watt/m2
Radiation Sum	5603 J/cm2
Rain Flow	<NONE>
Daily Rain	0.0mm

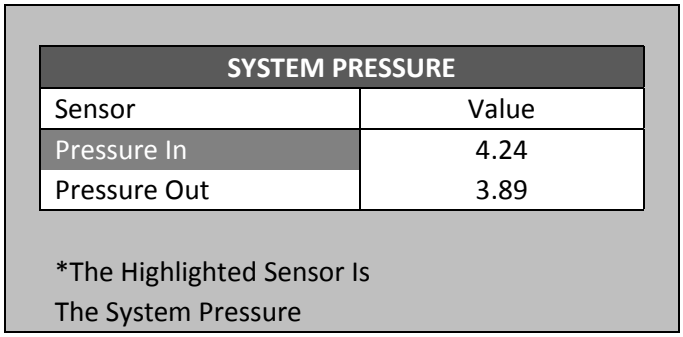
WEATHER STATION

- **Outside Temperature** (°C) – Outside temperature reading.
- **Outside Humidity** (%RH) – Outside relative humidity reading.
- **Wind Direction** (0° - 360°) – Wind direction reading.
- **Wind Speed** (km/h) – Wind speed reading.
- **Radiation** (W/m²) – Measured radiation level.
- **Rad Sum** (J/cm²) – Measured radiation sum form **End Day Time** set in **6.1 TIME & DATE** which can be accessed from the 6.Setup icon.
- **Rain Status** (Not visible on above screen) – Rain status shown as **No Rain / Rain**.
- **Rain Flow** (mm/h) – Measured rain flow.
- **Daily Rain** (mm) – Measured rain quantity form **End Day Time** set in **6.1 TIME & DATE** which can be accessed from the **6.Setup** icon.

HOT SCREEN 8 – SYSTEM INLET AND OUTLET PRESSURES:

JR	This feature is not available in the NMC Junior.

FIGURE 17. HOT SCREEN 8 - DISPLAY OF PRESSURE SENSOR READINGS



SYSTEM PRESSURE

- **Sensor**
  - **Pressure In** – System inlet pressure (upstream of filter).
  - **Pressure Out** – System outlet pressure (downstream of filter).
- **Value** (bar)
  - Pressure reading from sensors connected.

NB	The highlighted sensor is the system pressure as set in line Low Pressure Alarm in sub menu **7.10 SYSTEM PRESSURE CONFIGURATION** which can be accessed from the **7.CONFIG** icon.

4.2.0.8 CHECKING NMC PRO CONTROLLER SOFTWARE VERSION

To check the NMC Pro Controller Software version, by pressing MENU navigate to the system **MAIN MENU** screen and from there, toggle with the MENU key to the default hot screen. Press the **HELP** button when in the default hot screen. The **SOFTWARE VERSION SCREEN** will be displayed. This screen provides information on the software version, release date, communication version, relay card version, digital input card version*, boot version* and run time.

Press **ENTER** to exit **SOFTWARE VERSION SCREEN**.

JR	*The digital input card version and the boot version are not applicable to the NMC Junior.

4.2.0.9 RESETTING NMC PRO CONTROLLER

In the unlikely event that the controller software for example “freezes” or a software setting change is not implemented, the controller could require a reset.

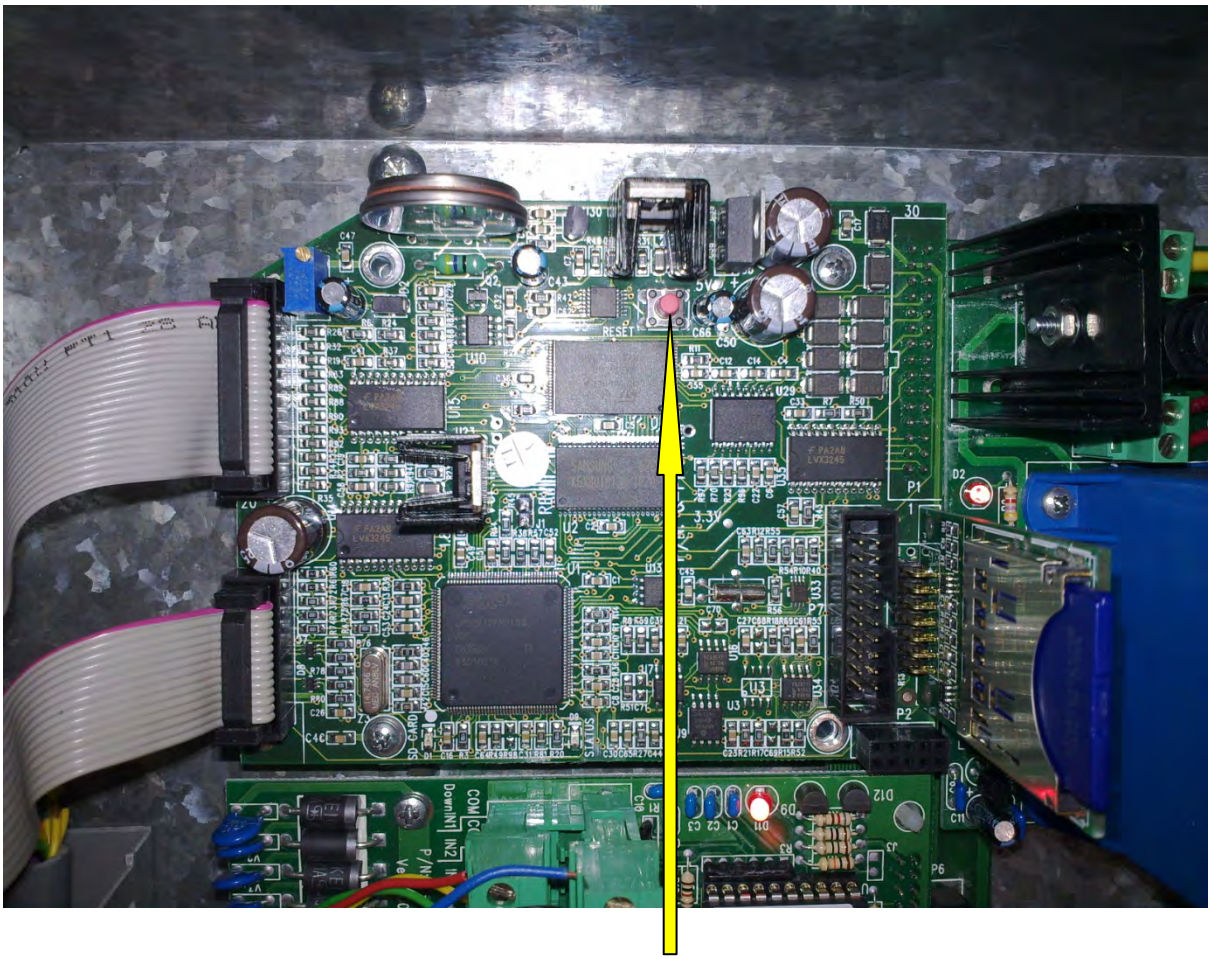
The NMC Pro Controller can be reset by:

- 1) Warm Reset or
- 2) Cold Start.

4.2.0.9.1 WARM RESET

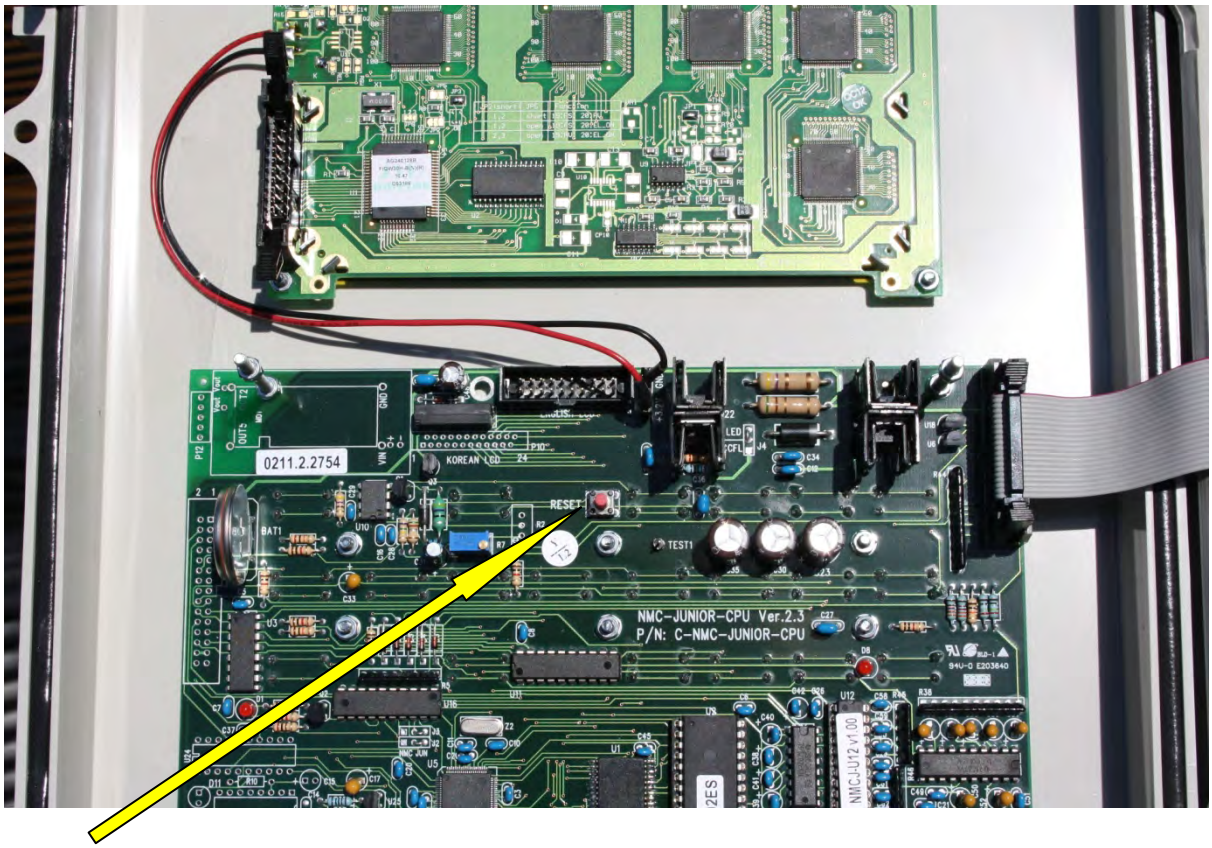
- During a **Warm Reset** the controller CPU is restarted. The program and configuration settings will not be lost.
- It is recommended to perform this procedure before doing a **Cold Start**.
- To perform a **Warm Reset,** stop all active irrigation processes and then depress the reset button on the CPU. The reset button can be released when no text is displayed on the controller screen. (See FIGURE 18 for the NMC Pro and FIGURE 19 for the NMC Junior)
- After **Warm Reset** procedure has ended the NMC Pro will return to the **MAIN** screen.

FIGURE 18. NMC PRO - WARM RESET



Warm reset button

FIGURE 19. NMC JUNIOR - WARM RESET



Warm reset button. This button is underneath a steel protective cover. The cover is not shown in this diagram. The reset button can be accessed without removing the cover.

4.2.0.9.2 COLD START

- **Cold Start** resets the NMC Pro to the original factory settings. This procedure should be performed:
  - After upgrading the controller software version
  - When reinstalling the controller
  - After adding input or output cards
  - When instructed by a Netafim technician

NB	All program and configuration settings will be lost, it is therefore recommended to perform a back-up to the Data Plug before starting this procedure. See section 6.9 WRITE TO DATA PLUG for instructions on performing the back-up and section 6.10 READ FROM DATA PLUG to restore controller settings.

- To perform a cold start:
    - Disconnect the NMC Pro power supply.
    - Turn power on while depressing the **DELETE** key until the **COLD START** pop-up screen appears.
        - If you choose "**NO**", the NMC Pro will continue to its usual power-up procedure and the settings will remain untouched.
        - If you choose "**YES**", NMC Pro will perform the cold start procedure and the controller will start with RAM and EPROM cleaning procedure. All controller settings will be erased and restored back to default factory settings. All history will be erased.
    - After the **cold start** procedure has ended, the NMC Pro will return to the **MAIN** screen.

4.2.0.10 ANALOGUE INPUTS

Analogue inputs are received from an analogue sensor as either a voltage or a current. However a computer cannot read such a value without it being converted to a digital number. The analogue inputs in several of the NMC software's screens such as 'Status' and 'Test' screens are displayed in values which are labelled as 'A/D'.

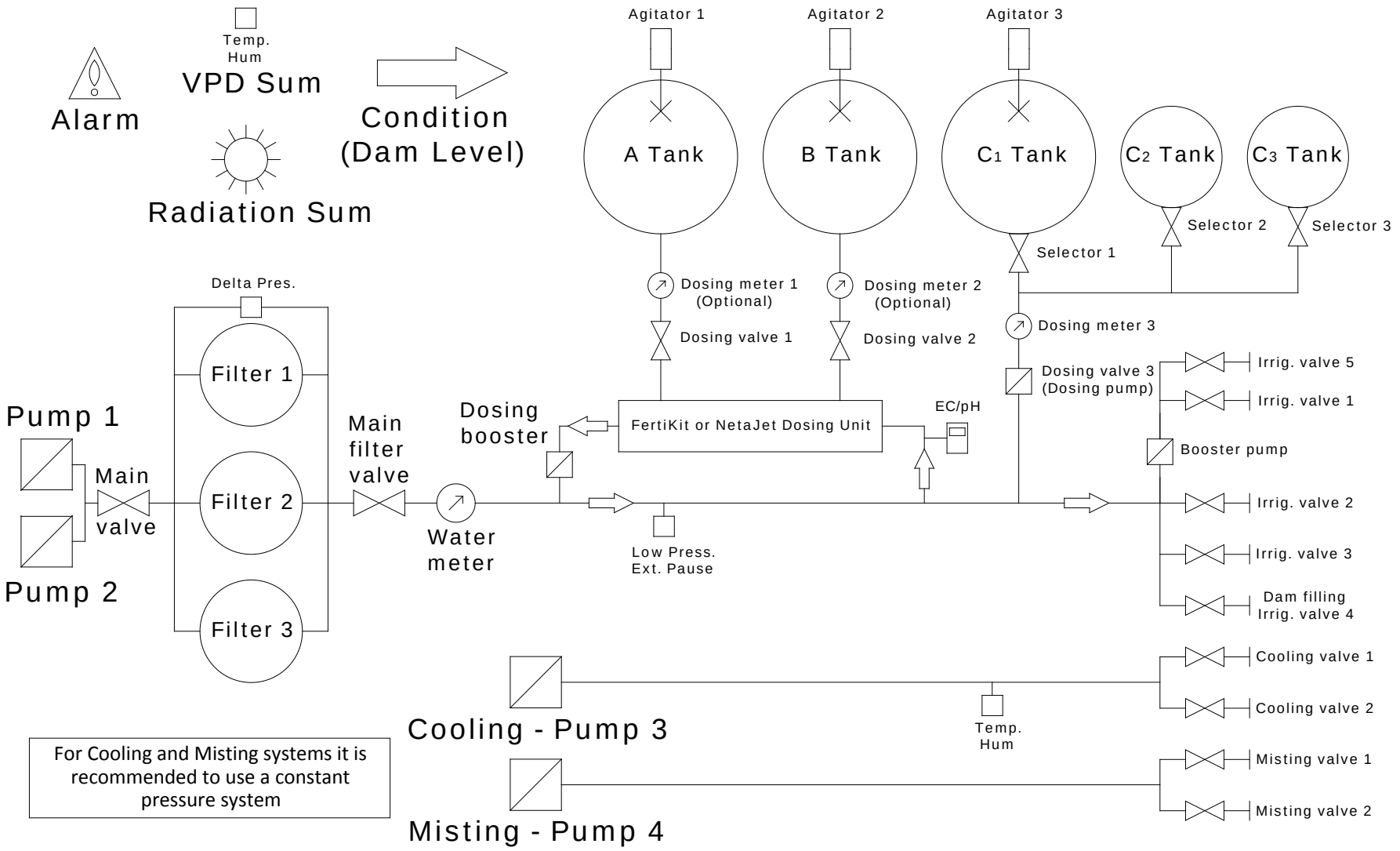
'A/D' = Analogue-to-digital converter

This simply means analogue-to-digital converter and the values displayed in these screens are numbers that can be read by a computer: in this case the NMC Controller. The numbers themselves have no unit of measurement. They are more like a code, which the controller is pre-programmed to read.

TABLE 3. NMC PRO IRRIGATION SOFTWARE MENU STRUCTURE

1. Program	**2.** Manual	**3.** Alarm	**4.** History	**5.** Test	**6.** Set-up	**7.** Configuration	**8.** Installation
1.1 Irrigation	2.1 Irrigation pause	3.1 Alarm reset	4.1 Irrigation log	5.1 Relays	6.1 Time & date	7.1 Device delay configuration	8.1 Device layout
1.2 Water run time	2.2 Start/Stop program	3.2 History	4.2 Rad. sum & drain log	5.2 Digital input	6.2 System set-up	7.2 Pump station configuration	8.2 Device list
1.3 Dosing	2.3 Start/Stop valve	3.3 Alarm definition	4.3 Uncompleted irrigations	5.3 Analogue input	6.3 Temperature calibration	7.3 Valve configuration	8.3 Digital input
1.4 Ext. condition	2.4 Filter flushing	3.4 Alarm setting	4.4 Uncompleted programs	5.4 Temperature	6.4 Humidity calibration	7.4 Valve flow rate	8.4 Analogue input 1
1.5 Agitator		3.5 EC/pH alarm definition	4.5 Daily irrigation	5.5 Humidity	6.5 EC/pH calibration	7.5 Water meter	8.5 * Analogue input 2
1.6 Selector		3.6 EC/pH alarm setting	4.6 Irrigation accumulation	5.6 * Hardware checklist	6.6 * Pressure calibration	7.6 Dosing channel configuration	8.6 * Hardware checklist
1.7 Filter flushing		3.7 *Not applicable*	4.7 Water & aux. accumulation	5.7 ** Power and communication	6.7 * Weather station calibration	7.7 Dosing configuration	
1.8 Cooling		3.8 *Not applicable*	4.8 Accumulation reset		6.8 Sensors logging (6.6)	7.8 EC pre-control configuration	
1.9 Misting		3.9 * SMS Subscription	4.9 Filters		6.9 Write to data plug (6.7)	7.9 * Drainage configuration	
1.10 Water heating			4.10 Cooling		6.10 Read from data plug (6.8)	7.10 * System pressure configuration	
			4.11 Sensors log		6.11 * Edit SMS phonebook	7.11 * Radiation configuration	
			4.12 Event log		6.12 * SMS setup	7.12 EC/pH configuration (7.9)	
			4.13 System log		6.13 * SMS personal message	7.13 * Pressure sensor range definition	
JRDC	**5.7 applies to the NMC DC only. * These features are not available in the NMC Junior. The numbers in parentheses () are the index numbers in the NMC Junior where they differ from the NMC Pro.				6.14 * VPD sensor setup	7.14 Cooling configuration (7.10)	
						7.15 Misting configuration (7.11)	

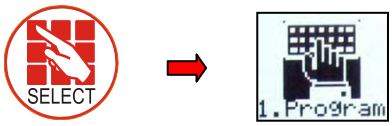
FIGURE 20. NMC PRO IRRIGATION SOFTWARE CASE STUDY
All settings shown in control screens based on case study



4.2.1 PROGRAM

In the MAIN MENU screen place the cursor on the program icon and press **ENTER**, or press "1" to enter the 1.PROGRAM menu.

FIGURE 21. PROGRAM MENU SCREEN



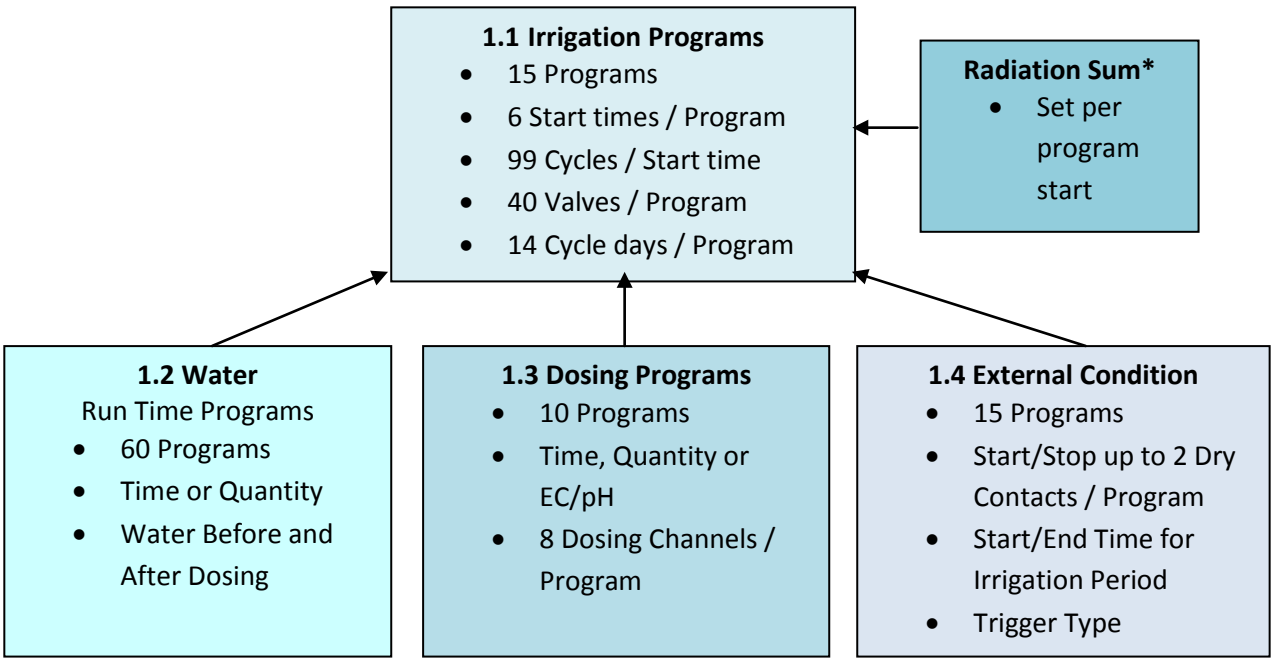
	PROGRAM
1.	IRRIGATION
2.	WATER RUN TIME
3.	DOSING
4.	EXT. CONDITION
5.	AGITATOR
6.	SELECTOR
7.	FILTER FLUSHING
8.	COOLING
9.	MISTING
10.	WATER HEATING

NB	To enter any of the sub menus, press the corresponding numeric key or scroll to the desired item using the up/down arrow keys and press **ENTER**. A new window will appear. The first menu under **Program** is **Irrigation**.

4.2.1.1 IRRIGATION

The NMC Pro Irrigation Controller includes 15 irrigation programs. The irrigation program depends on the **1.2 WATER RUN TIME** program, **1.3 DOSING** program and **1.4 EXTERNAL CONDITION** program, therefore it is recommended to configure these screens before irrigation programming takes place. Only **one IRRIGATION PROGRAM** can operate at any one time and is influenced by other programs and triggers as shown by the diagram:

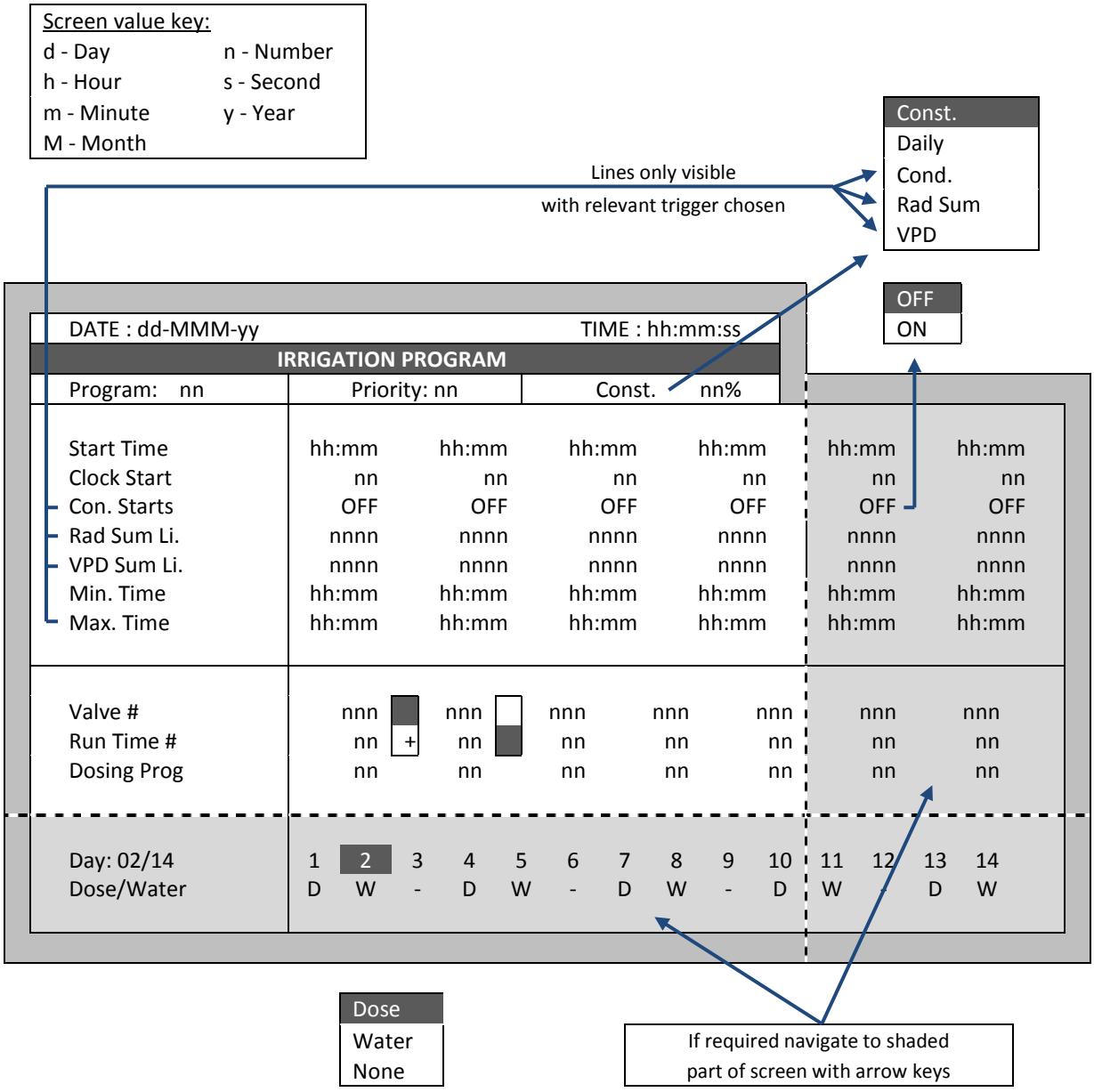
FIGURE 22. IRRIGATION PROGRAM DEPENDENCIES



JR	*Radiation sum is not available in the NMC Junior.

IRRIGATION PROGRAM SCREEN showing pull-down menus and screen lines inter-connected to program trigger options:

FIGURE 23. IRRIGATION PROGRAM SCREEN



- **DATE** – Displays current date.
- **TIME** – Displays current time.
- **IRRIGATION PROGRAM**
  - **Program [Value in range 1 to 15]** – Select a program by entering the program number and confirm by pressing ENTER.
  - **Priority [Value in range 0 to 15]** - Priority determines the order in which program starts will take place. If start time is the same, higher priority programs come first. Higher priority programs do not stop currently operative programs. If start time and priority are the same, irrigation programs with a lower number are executed first. Priority ranges are between 0 and 15, 15 being the highest.
  - **Constant / Daily / Condition / Radiation Sum**

- **Constant [Value in range -100% to 999%]** – Increase or decrease the irrigation run time/quantity for all valves included in this program. 0% means the time/quantity will be as specified in the **1.2 WATER RUN TIME** program, 100% will be twice the time/quantity and –50% will be half the time/quantity specified in the **1.2 WATER RUN TIME** program. To decrease enter the required percentage of change, press the **+/-** key and then confirm with the **ENTER** key. The percentage of change will be active until you specify otherwise.
- **Daily [Value in range -100% to 999%]** – Increase or decrease the irrigation run time/quantity for all valves included in this program. 0% means the time/quantity will be as specified in the **1.2 WATER RUN TIME** program, 100% will be twice the time/quantity and –50% will be half the time/quantity specified in the **1.2 WATER RUN TIME** program. To decrease enter the required percentage of change, press the **+/-** key and then confirm with the **ENTER** key. The percentage of change will be active only for the present day.

	**Constant %** and **Daily %** do not change time/quantity of water before and after settings, nor dosing quantities. When setting watering program and using **Spread** the percentage affects not only the water but also the dosing.

- **Condition [Value in range 0 to 15]** – Specify whether the condition program can start/stop irrigations, and choose a condition program number to start/stop irrigations. Irrigations will be started and stopped according to the settings of the relevant condition program (see 1.4 EXTERNAL CONDITION program for additional information).
- If irrigation is not triggered due to the relevant condition program and the maximum time (see Maximum Time below) has lapsed, irrigation will be performed. When choosing condition, the screen will be split in two. To view the cycle sequence, press the down arrow when the cursor is placed on the bottom of the screen. The condition program has the third priority after active irrigation and uncompleted irrigation.

	It is not possible to set the same **Condition** program for two different programs.

- **Radiation Sum / VPD Sum** – Select option if irrigations can be triggered by the radiation sum / VPD sum. The specific radiation sum limit / VPD sum limit used to trigger irrigation are specified per period (see **Radiation Sum Limit / VPD Sum Limit** below).
- If irrigation is not triggered due to the relevant **Radiation Sum Limit / VPD Limit** and the maximum time (see Maximum Time below) has elapsed irrigation will be performed. When choosing Radiation Sum, the screen will be split in two. To view the cycle sequence, press the Down arrow when the cursor is placed on the bottom of the screen.

	*Radiation / VPD sums are not available in the NMC Junior.

- **Start time [Value in range 00:01 to 23:59] - ENTER** up to 6 start times (periods) per day for each program. Setting start time as **00:00** means program is **off**.
- **Clock Start [Value in range 0 to 99]** - Set the number of irrigation cycles that must be performed in this period. For **Constant** and **Daily** the first cycle will start at the specified start time, subsequent cycles will start after the specified delay time set (see **Minimum Time** below).

	In the NMC Junior, this feature is called 'Cycles'. Set the number of irrigation cycles for each period. The first cycle starts at the specified start time. Subsequent cycles will start after the specified 'Delay' time in the row underneath.

- **Condition Starts [Value in range ON or OFF]**
  - **On** – Irrigations can be triggered by the **1.4 EXTERNAL CONDITION** program if the specified condition program settings are met (condition program active).
  - **Off** – Irrigations will not be triggered by the **1.4 EXTERNAL CONDITION** program regardless of the condition program status.
- **Radiation Sum Limit. [Value in range 0 to 9999]** – Specify the radiation sum limit at which irrigation will take place. The radiation sum counter of the specific program is automatically reset when irrigation is performed. If radiation sum limit is "0" it is ignored.
- **VPD Sum Limit**. **[Value in range 0 to 9999]** – Specify the VPD sum limit (kPa.min) at which irrigation will take place. The radiation sum counter of the specific program is automatically reset when irrigation is performed. Irrigation based on VPD sum occurs only during the VPD time frame set in Sub-menu 6.1. See Section 3.2.6.1 *Installation – Software – Irrigation*.
- **Minimum Time [Value in range 00:00 to 23:59]** – For time based irrigation the minimum time (delay time) between cycles is counted from start of previous cycle to start of next cycle. For condition and radiation sum modes this setting is used to determine the minimum time allowed between irrigations. If the condition program becomes active or the radiation sum limit has been reached, irrigation will not be performed until this time has elapsed.
- **Maximum Time [Value in range 00:00 to 23:59]** – The maximum time between two subsequent cycles. This value is used to limit the time between two cycles when using dynamic irrigation triggers such as condition program or radiation sum limit. When the specified maximum time from the start of the previous cycle has elapsed, irrigation will take place regardless of the condition program status or radiation sum value.

	In the NMC Junior, the minimum and maximum times are replaced by 'Delay': the time between the start of a cycle and the start of the next cycle. For example, if the set 'Run Time' is 30 minutes and the 'Delay' is 45 minutes, the second cycle will start 15 minutes after the end of the first cycle.

- **Valve # [Value in range 0 to 255]** - The NMC Pro can operate valves in any required order.
  - Set the valve number and press **ENTER**.

    The following window will appear: 

  - Select "blank" and press **ENTER** to set the valve to operate alone, or select "**+**" (plus) to operate together with the next valve. Several valves can be set to work together as a group. A valve group will have the same **1.2 WATER RUN TIME** program and the same **1.3 Dosing** program (the **1.2 WATER RUN TIME** and/or **1.3 DOSING** program numbers set for the valve to the far left of the group will be used). Each irrigation program can include a maximum of 40 valves (columns) in any required order (all of them set to work together, one after the other, a few groups, etc.). The same valve can be entered several times with different settings.

	In this window in the NMC Junior, 'blank' is replaced with a minus '-'.

- **Run Time # [Value in range 0 to 60] – ENTER** a **1.2 WATER RUN TIME** program number for a valve or a group of valves. When setting valves to work individually a **1.2 WATER RUN TIME** program should be set for each valve. When setting a group of valves to work together ("**+**" mark between them) a **1.2 WATER RUN TIME** program should only be set for the valve to the far left of the group, the rest of the valves will follow this setting. The quantity set in the **1.2 WATER RUN TIME** program for a valve group will be the quantity given for all valves set to operate together not per valve (also see **1.2 WATER RUN TIME** program).
- **Dosing Program [Value in range 0 to 10] – ENTER** a **1.3 DOSING** program number for a valve or a group of valves. When setting valves to work individually a **1.3 DOSING** program should be set for each valve. When setting a group of valves to work together ("**+**" mark between them) a **1.3 DOSING** program should only be set for the valve to the far left of the group, the rest of the valves will follow this setting (also see **1.3 DOSING** program).
- **Day: (xx/xx) [Value in range 1 to 14]** – Cycle days, set the right hand side value (number of cycle days) first see below:
  - (**xx**/xx) - The left hand side setting defines the current day in the cycle. The standard setting for current day when using cycle days to irrigate according to days of the week is to set Monday as day 01.
  - (xx/**xx**) - The right hand side setting defines the number of cycle days to use per program.
  - (**x x x** ……) – The complete cycle (number of days set) will be displayed to the right hand side of the screen. The current day in the cycle will be highlighted.

- **Dose / Water [Value in range Dose, Water or None]:**
  - By moving the curser with the arrow keys to the relevant cycle day and pressing **ENTER** the following screen will be displayed:

Dose Water None

  - Set the action to be taken for each cycle day by selecting **Dose, Water** or **None** and press **ENTER**. "Dose" means fertigation (water + dosing), "**Water**" means irrigation without dosing and "**None**" means the program is idle in that day.
  - The dosing operates according to **Dose** or **Water** for the present day and not according to the setting when the irrigation has started. If an irrigation starts at 18:00 and on this day dosing is set ("**D**") when the irrigation crosses midnight to a day where no dosing is set ("**W**") dosing stops at midnight.

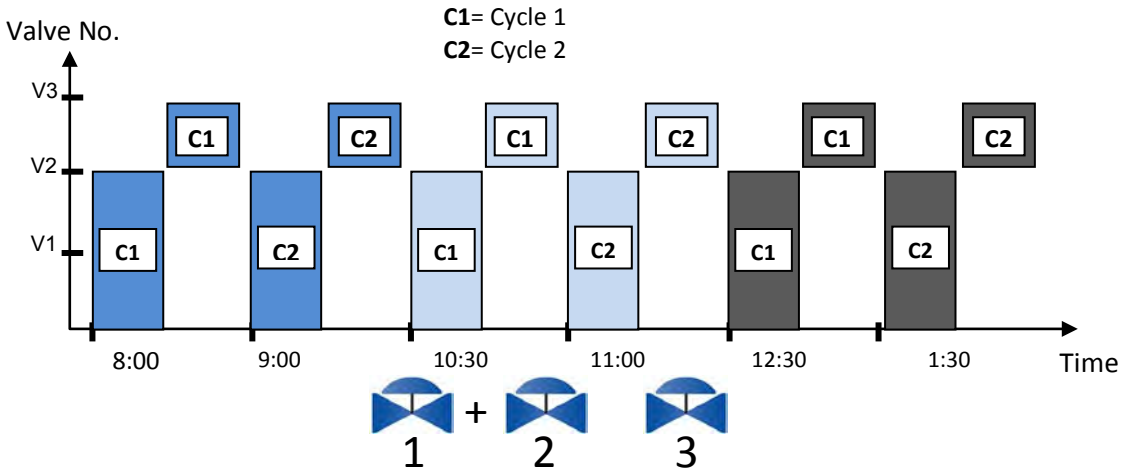
NB	With an Irrigation Program that includes **1.3 DOSING** program numbers for valves, dosing will always start if the program is started manually. To stop dosing for manual irrigation program start, change the dosing rate set in **1.3 DOSING** program quantities to 0.

Setting irrigation that is longer than 24 hours

If the number of cycle days is set as 1 and the water run time is over 24 hours, the irrigation will repeat itself continuously, which means continuous irrigation.

4.2.1.1.1 EXAMPLE: IRRIGATION BASED ON TIME

FIGURE 24. IRRIGATION BASED ON TIME - EXAMPLE



For program 1, valve numbers 1 and 2 are required to run as a group (simultaneously) and valve number 3 to work independently. All valves must run 6 cycles but cycle starts are not at the same interval.

FIGURE 25. IRRIGATION PROGRAM SCREEN FOR TIME BASED IRRIGATION EXAMPLE

DATE : 01-Feb-08		TIME : 08:30:30
IRRIGATION PROGRAM		
Program: 1	Priority: 15	Const. 20%
Start Time	08:00 10:30 12:30	
Clock Start	2 2 2	
Min. Time	01:00 00:30 01:00	
Valve #	001 + 002 003	
Run Time #	1 1 2	
Dosing Prog	1 1 2	
Day: 02/07	1 2 3 4 5 6 7	
Dose/Water	- D - D - D D	

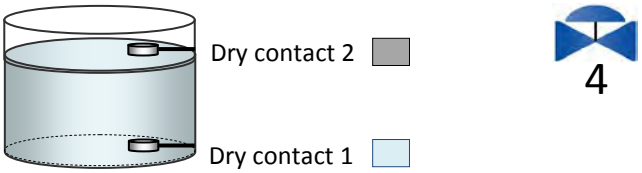
Due to climatic conditions it is required to increase irrigation run time by 20%.

S	M	T	W	TH	F	ST
X		X		X		X

Days of week to irrigate:
Tuesday, Thursday,
Saturday and Sunday.

4.2.1.1.2 EXAMPLE: IRRIGATION BASED ON EXTERNAL CONDITION (STORAGE TANK LEVEL)

FIGURE 26. IRRIGATION BASED ON STORAGE TANK LEVEL

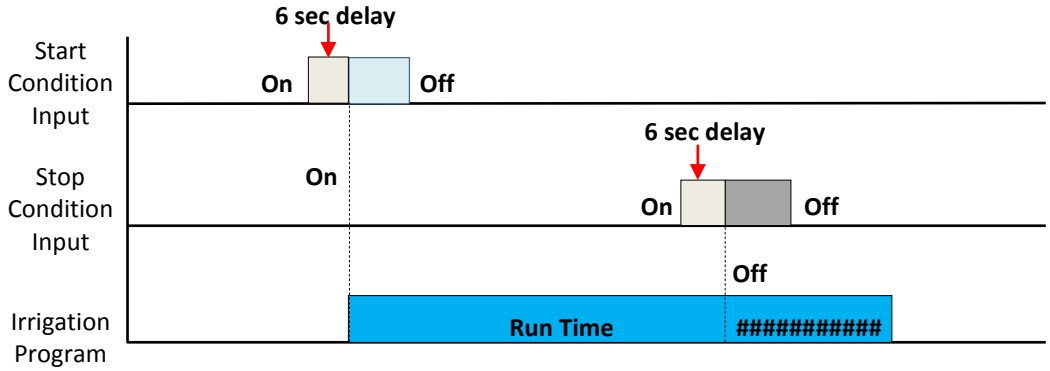


Valve number 4 is used for dam filling. Program 3 will be used to control the dam filling through a **1.4 EXTERNAL CONDITION** program. Dry contact 1 (Low Level Sensor) will start program 3 and Dry contact 2 (High Level Sensor) will stop program 3.

FIGURE 27. IRRIGATION PROGRAM SCREEN – EXAMPLE FOR EXTERNAL CONDITION

DATE : 01-Feb-08		TIME : 08:30:30
IRRIGATION PROGRAM		
Program: 3	Priority: 13	Cond. 1
Start Time	08:00	
Clock Start	--	
Con. Starts	ON	
Min. Time	00:00	
Max. Time	00:00	
Valve #	004	
Run Time #	3	
Dosing Prog	3	
Day: 01/01	1	
Dose/Water	D	

FIGURE 28. IRRIGATION RUN TIME FOR EXTERNAL CONDITION EXAMPLE



4.2.1.1.3 EXAMPLE: IRRIGATION BASED ON RADIATION SUM

FIGURE 29. IRRIGATION BASED ON RADIATION SUM

Between 08:00 to 10:00 radiation sum level to start irrigation is 300J/cm². Irrigation required every 30 minutes to 1 hour.

Between 10:00 to 16:00 radiation sum level to start irrigation is 150J/cm². Irrigation required every 20 minutes to 1 hour.

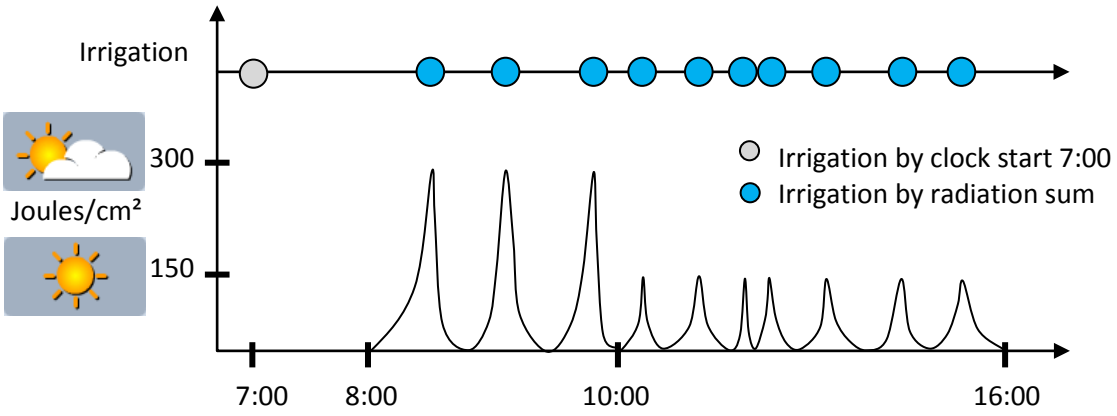
Program 2 will be used to control valve numbers 1, 2, and 3 by radiation sum limit. In addition to control by radiation sum limit, 1 irrigation cycle is required to at 07:00 to start the day's irrigation. After 16:00 no more irrigation cycles are required.

FIGURE 30. MENU 1.1 IRRIGATION PROGRAM SCREEN – EXAMPLE FOR RADIATION SUM

DATE : 01-Feb-08		TIME : 08:30:30	
IRRIGATION PROGRAM			
Program: 2	Priority: 14	Rad Sum	
Start Time	07:00	08:00	10:00	16:00
Clock Start	1	- -	- -	- -
Rad Sum Li.	- - - -	300	150	- - - -
Min. Time	- - : - -	00:30	00:20	- - : - -
Max. Time	- - : - -	01:00	01:00	- - : - -
Valve #	001	002	003	
Run Time #	2	2	2	
Dosing Prog	2	2	2	
Day: 01/01	1			
Dose/Water	D			

FIGURE 31. GRAPHICAL REPRESENTATION OF IRRIGATION BY RADIATION SUM

This graphic is according to the settings in FIGURE 30



4.2.1.1.4 EXAMPLE: IRRIGATION BASED ON VAPOUR PRESSURE DEFICIT (VPD) SUM

Irrigation starts based on VPD sum are done according to the accumulation of units of VPD multiplied by time and measured in kilopascal-minutes (kPa·min).

VPD

Vapour pressure deficit is the difference in vapour pressure measured in kPa between saturated air (100% relative humidity, inside the stomata of the plant leaves) and the actual air vapour pressure (less than 100% humidity, away from the plant leaves).

EQUATION 1. VPD

	VP saturation	(kPa)
Less	VP air	(kPa)
=	VPD	(kPa)

These theoretical vapour pressures can be estimated by measuring the air temperature and the relative humidity. The NMC Pro software calculates the VPD using readings from a temperate sensor and a relative humidity sensor.

VPD Sum

The irrigation interval between irrigation starts is set according to a chosen VPD sum, which multiplies the VPD in kPa by time in minutes.

EQUATION 2. VPD SUM

VPD sum (kPa·min) = VDP (kPa) x accumulated time (minutes)

The VPD sum at which to irrigate is chosen by the irrigation operator. The NMC software allows the operator to select different VPD sums for different periods of the day.

FIGURE 32. IRRIGATION BASED ON VPD SUM

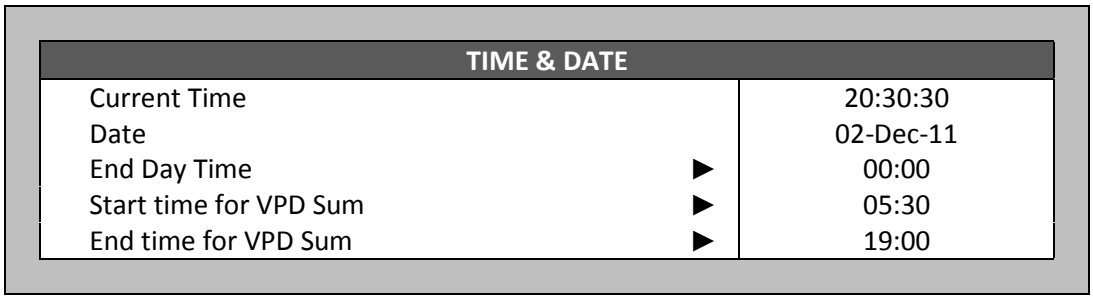
Between 06:00 to 10:00 and 16:00 to 19:00 the VPD sum level to start irrigation is 120 kPa·min. Irrigation required every 40 mins to 2 hours.

Between 10:00 to 16:00 the VPD sum level to start irrigation is 80 kPa·min. Irrigation required every 20 minutes to 1 hour.

1 2

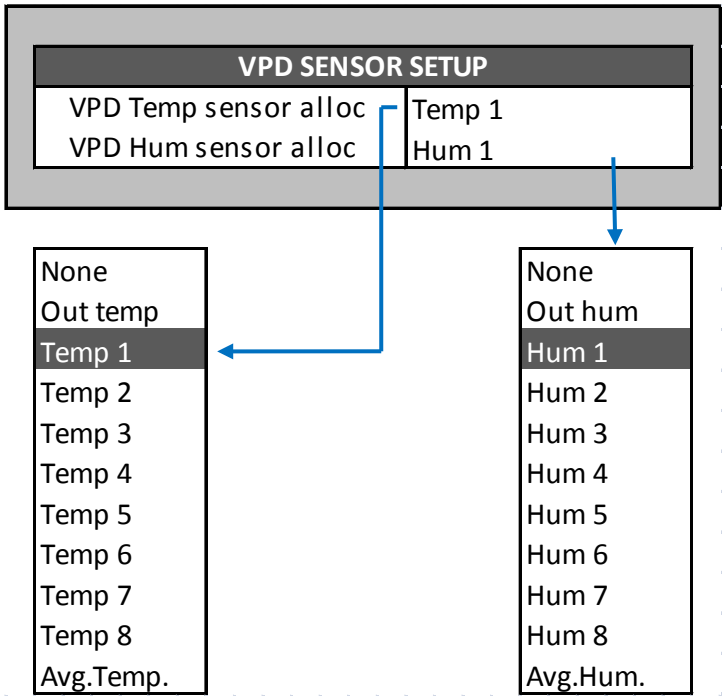
Program 5 will be used to control valve numbers 1 and 2 by VPD sum limit. In addition to control by radiation sum limit, 1 irrigation cycle is required to at 05:30 to start the day's irrigation. After 19:00 no more irrigation cycles are required.

FIGURE 33. MENU 6.1 TIME & DATE SCREEN – EXAMPLE FOR VPD SUM



The setting of the time and date is explained in section 3.2.6.1 of *Installation – Software – NMC Irrigation* of the *CMT Manual.*

FIGURE 34. MENU 6.14 VPD SENSOR SETUP – EXAMPLE FOR VPD SUM



The selection of the temperature and humidity sensors is explained in section 3.2.6.14 of *Installation – Software – NMC Irrigation* of the *CMT Manual.*

FIGURE 35. MENU 1.1 IRRIGATION PROGRAM SCREEN – EXAMPLE FOR VPD SUM

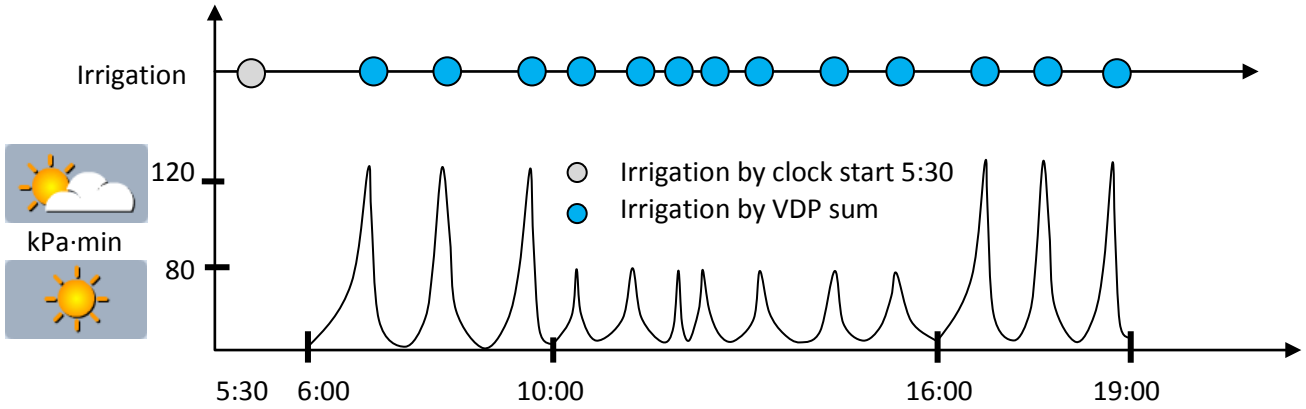
DATE : 02-Dec-11 TIME : 20:30:30

IRRIGATION PROGRAM

Program: 5	Priority: --		VPD Sum		
Start Time	05:30	06:00	10:00	16:00	19:00
Clock Start	1	--	--	--	--
VPD Sum Li.	----	120	80	120	----
Min. Time	--:--	00:40	00:20	00:40	--:--
Max. Time	--:--	02:00	01:00	02:00	--:--
Valve #	001	002			
Run Time #	1	1			
Dosing Prog	--	--			
Day: 01/01	1				
Dose/Water	W				

FIGURE 36. GRAPHICAL REPRESENTATION OF IRRIGATION BY VPD SUM

This graphic is according to the Irrigation Program settings above.



4.2.1.2 WATER RUN TIME

The water run time table has 60 “floating” programs, each program can be configured so that irrigation water is given in quantity (m^3) or in time (hh:mm:ss). The programs can be connected to a valve or a group of valves through the **1.1 IRRIGATION** program. Each program includes water, water before and after settings.

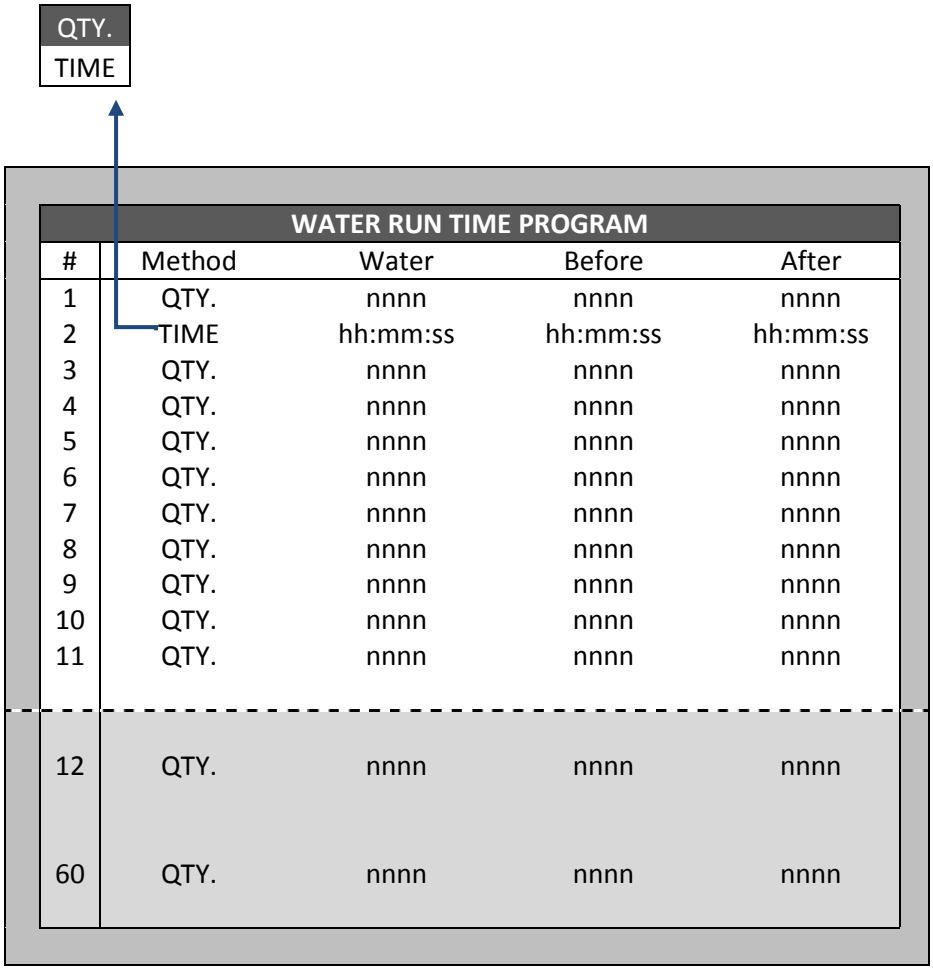


FIGURE 37. WATER RUN TIME PROGRAM SCREEN

WATER RUN TIME PROGRAM

- **# (Water run time program number)**
  - Water run time program number used in **1.1 IRRIGATION** program for the run time # which is connected to a valve or a group of valves.
- **Method [Value in range QTY. or TIME]** – Select the method (QTY. or TIME) with the up/down arrow keys and press **ENTER** to confirm.
  - **QTY**. – Irrigation run time will be according to quantity of water in m^3.
  - **TIME** - Irrigation run time will be according to time of in hh:mm:ss.
- **Water [Value in range 0 to 9999 for QTY. and 0 to 99:59:59 for TIME]** – Set the quantity / time for each program. The water setting is the total quantity / time including the Before and After settings.
- **Before [Value in range 0 to 9999 for QTY. and 0 to 99:59:59 for TIME]** – Set quantity/time without dosing at the beginning of each irrigation cycle.

- **After [Value in range 0 to 9999 for QTY. and 0 to 99:59:59 for TIME]** – Set quantity/time without dosing at the end of each irrigation cycle.

NB	**Before** and **After** settings are deducted from **Water** settings. Therefore **Water** quantity/time must be larger or equal to the **Before** and **After** settings.

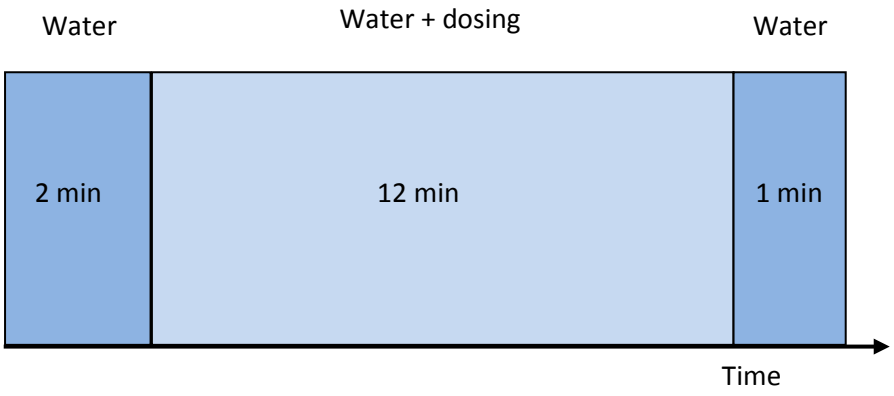
Example: Water Run Time Program

Three different run runtimes are required to operate the irrigation system as set out below:

FIGURE 38. WATER RUN TIME PROGRAM EXAMPLE

WATER RUN TIME PROGRAM				
#	Method	Water	Before	After
1	TIME	00:15:00	00:02:00	00:01:00
2	QTY.	4	0.5	1.2
3	QTY.	50	0	0
4	QTY.	0.000	0.000	0.000
5	QTY.	0.000	0.000	0.000
6	QTY.	0.000	0.000	0.000
7	QTY.	0.000	0.000	0.000
8	QTY.	0.000	0.000	0.000
9	QTY.	0.000	0.000	0.000
10	QTY.	0.000	0.000	0.000
11	QTY.	0.000	0.000	0.000

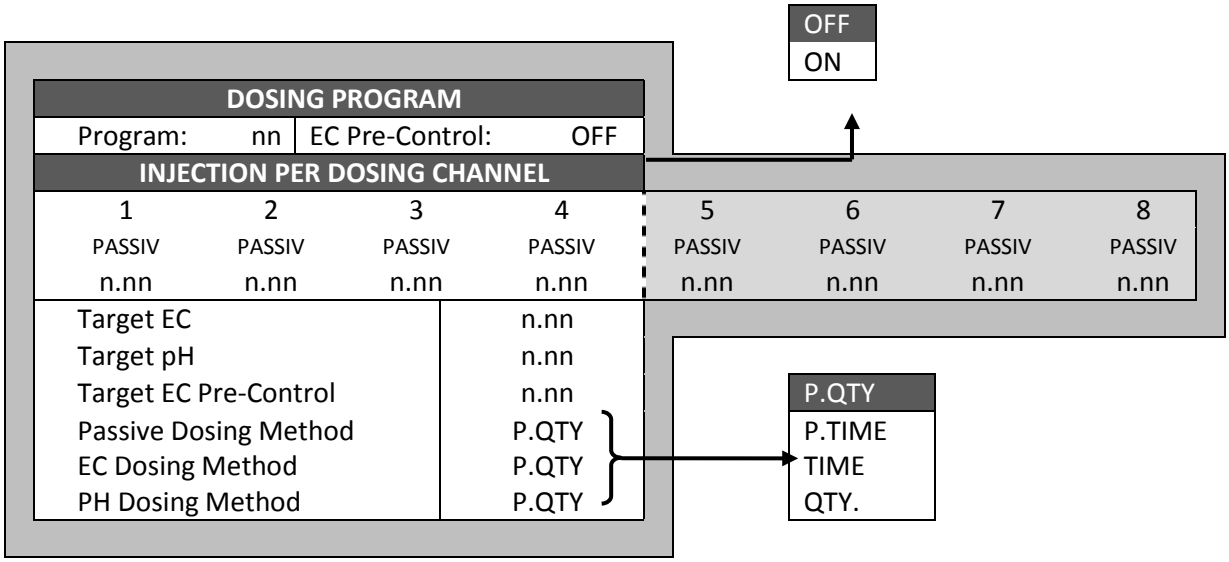
Before and **After** deducted from total **Time**.



4.2.1.3 DOSING

The NMC Pro Irrigation Controller includes 10 dosing programs (recipes). Each program consists of injection methods, injection rates and EC/pH target values. Each dosing channel is completely independent and can be set to inject a different amount. Overlapping between the various channels is possible.

FIGURE 39. DOSING PROGRAM SCREEN



DOSING PROGRAM

- **Program [Value in range 1 to 10]** – Select a program by entering the program number and confirm by pressing **ENTER**.
- **EC Pre-Control [Value in range OFF or ON]:**
  - **Off** – EC pre-control is not active for this dosing program. If the hydraulic system includes an EC pre-control system the valve will be shifted towards the fresh water source.
  - **On** – EC pre-control is active for this dosing program.

JR	The NMC Junior facilitates 8 dosing channels and only 6 dosing meters. EC Pre-control is not featured.

INJECTION PER DOSING CHANNEL

- **Dosing channel number** – 1 to 8.
- **Reaction** – A read only line indicating the injection method for the dosing channel (dosing channel reaction is set in screen **7.6 DOSING CHANNEL CONFIGURATION**):
  - **EC** – Dosing through this channel will be controlled by measured EC level.
  - **Acid** – This channel is used for high pH level correction. Dosing through this channel will be controlled by measured pH level**.**
  - **Passive** – Dosing through this channel do not respond to changes in measured EC or pH levels. This channel will be controlled as set in the dosing program regardless of the EC or pH values.

- **Alkali** – This channel is used for low pH level correction. Dosing through this channel will be controlled by measured pH level**.**

- **Dosing channel volume [Value in range 0 to 9999.99 or 0 to 99:59]** – Set the quantity / time to be injected for each dosing channel. The injection volume (proportional quantity, proportional time, time and quantity, see dosing injection method below) can be set separately for each reaction (method) of injection (EC, Acid, Passive, Alkali).
- **Target EC [Value in range 0 to 10]** – Set the required EC target value. This line will be visible if EC Control or EC Alarms are set to YES in screen **7.7 DOSING CONFIGURATION**.
- **Target pH [Value in range 0 to 14]** – Set the required pH target value. This line will be visible if pH Control or pH Alarms are set to YES in screen **7.7 DOSING CONFIGURATION**.
- **Target EC Pre-Control [Value in range 0 to 10]** – Set the required EC pre-control target value. This line will be visible if EC-Pre Control is set to ON, see EC-Pre Control above.
- **Passive Dosing Method [Value in range P.QTY, P.TIME, TIME or QTY.]** – Set the required injection method for the passive dosing channels (see **Dosing injection method** below).
- **EC Dosing Method [Value in range P.QTY, P.TIME, TIME or QTY.]** – Set the required injection method for the EC dosing channels (see **Dosing injection method** below).
- **pH Dosing Method [Value in range P.QTY, P.TIME, TIME or QTY.]** – Set the required injection method for the pH dosing channels (see **Dosing injection method** below).

DOSING INJECTION METHOD

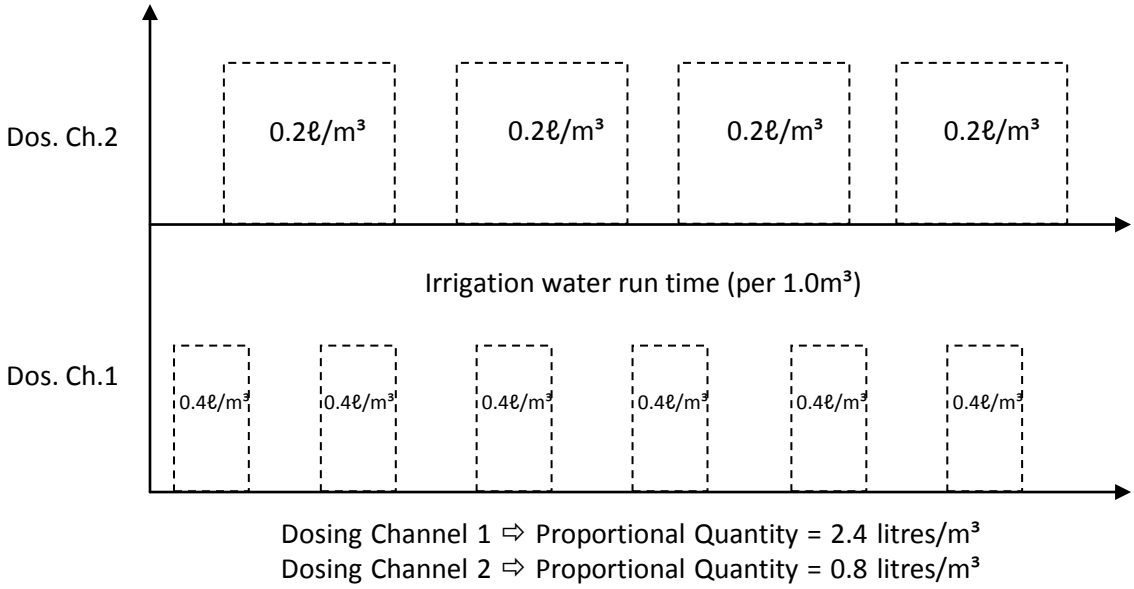
- **Proportional Quantity (liters/m³)** – Liters of fertilizer to inject per cubic meter (1000L) of irrigation water. Each dosing channel can be set to give a different amount.
  - For example:
    - If dosing channel is set to P.QTY of 5.0 ℓ/m³
    - and set water quantity is 15.0 m³/h
    - then the total quantity of fertilizer that will be given is 5.0 ℓ/m³ x 15.0 m³/h = 75 litres.
- **Proportional Time (hh:mm)** - The time to fertilize will be spread equally within the given irrigation time. Each dosing channel can be set to give a different amount.
  - For example:
    - Dosing channel 1 is set to 00:10 and dosing channel 2 is set to 01:00
    - Set irrigation water time is 3 hours.
    - The NMC Pro will proportionally divide (spread) the set dosing time for each dosing channel across the set irrigation time. Dosing channel 1 will be on for a total time of 10 minutes and dosing channel 2 will be on for a total time of 60 minutes during the 3 hours of irrigation.
- **Time (hh:mm)** – The time for dosing is entered for each dosing channel. Dosing will be done in one bulk that will start after water before time or quantity has elapsed as set in **1.2 WATER RUN TIME.**
- **Quantity (litres)** - The quantity for dosing is entered for each dosing channel. Dosing will be done in one **BULK** or **SPREAD** throughout the irrigation depending on the setting in 7.7 DOSING CONFIGURATION for the line **Dosing by QTY.Method**. Dosing will start after water before time or quantity has elapsed as set in **1.2 WATER RUN TIME**.

Example: Dosing Program based on Proportional Quantity (Open Field)

It is required from the fertigation program to inject 2.4 litres/m³ from Tank A (Dosing Channel 1) and 0.8 litres/m³ from Tank B (Dosing Channel 2). It is also required to receive alarms if the measured EC level deviates from the set level of 1.2 EC, pH correction is not required. Dosing program 1 will be used for this recipe:

FIGURE 40. DOSING PROGRAM - PROPORTIONAL DOSING EXAMPLE

DOSING PROGRAM			
Program:	1		
INJECTION PER DOSING CHANNEL			
1	2	3	
PASSIV	PASSIV	PASSIV	
2.40	0.8	0.00	
Target EC			1.2
Passive Dosing Method			P.QTY



Dosing Channel 1 ⇨ Proportional Quantity = 2.4 litres/m³
Dosing Channel 2 ⇨ Proportional Quantity = 0.8 litres/m³

From Example: Dosing Channel 1 = 0.4 + 0.4 + 0.4 + 0.4 + 0.4 + 0.4 = 2.4 litres/m³

Dosing Channel 2 = 0.2 + 0.2 + 0.2 + 0.2 = 0.8 litres/m³

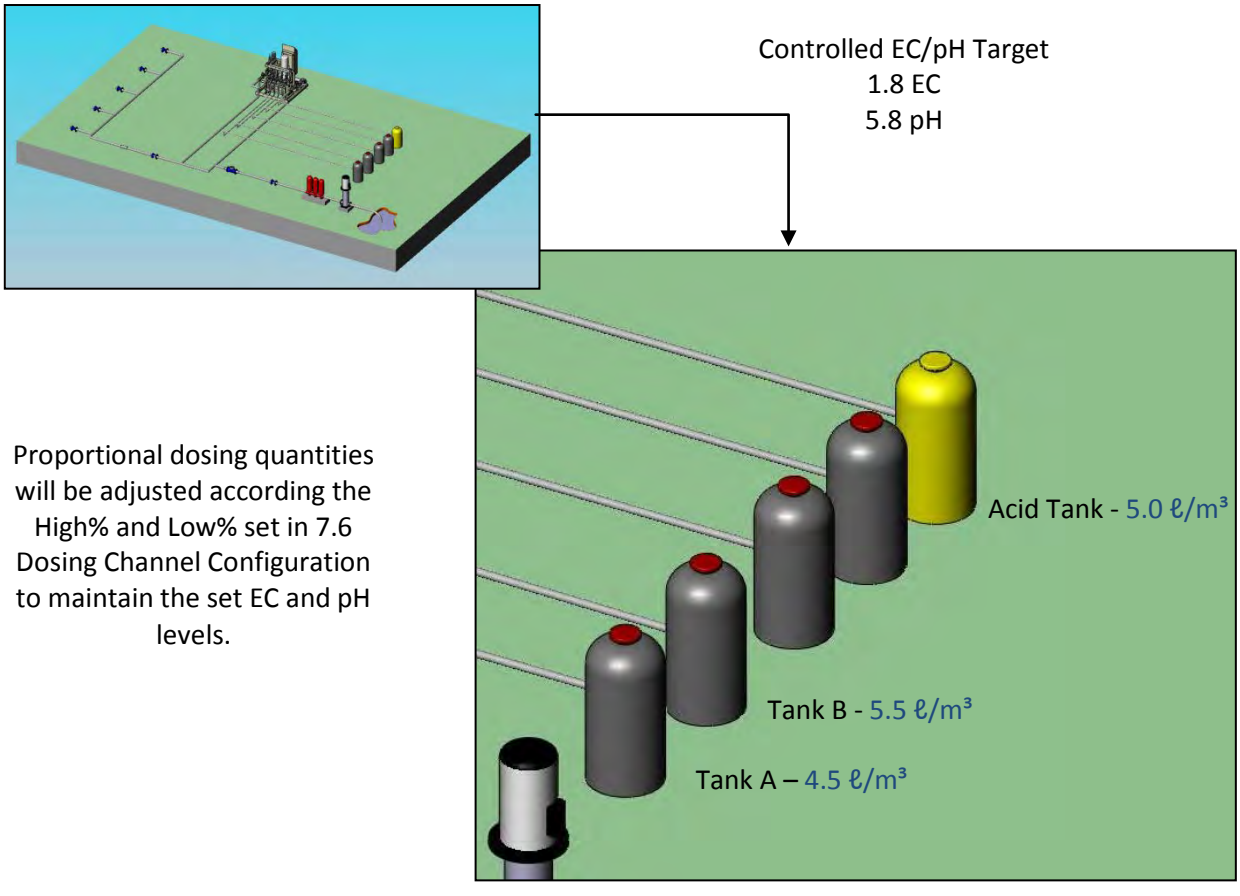
Example: Dosing Program based on Controlled EC and pH (Greenhouse)

It is required from the dosing system to maintain EC level at 1.8 EC and pH level at 5.8 throughout the dosing process. The fertigation program shows that to maintain above EC and pH levels the dosing system is required to inject 4.5 litres/m³ from Tank A (Dosing Channel 1), 5.5 litres/m³ from Tank B (Dosing Channel 2) and 5.0 litres/m³ Acid from Tank C1 (Dosing Channel 3). Dosing program 2 will be used for this recipe:

FIGURE 41. DOSING PROGRAM SCREEN – EC/pH BASED DOSING EXAMPLE

DOSING PROGRAM			
Program:	2		
INJECTION PER DOSING CHANNEL			
1	2	3	
EC	EC	ACID	
4.50	5.50	5.00	
Target EC			1.80
Target pH			5.80
EC Dosing Method			P.QTY
PH Dosing Method			P.QTY

FIGURE 42. DOSING PROGRAM – EC/pH BASED DOSING EXAMPLE



Example: Dosing program based on quantity (Treatment)

Dosing program 3 will be used for dam filling. It is required from the dosing system to inject 250 litres of the chemical in Tank C_2 (Dosing Channel 3) to do a chemical treatment on the water:

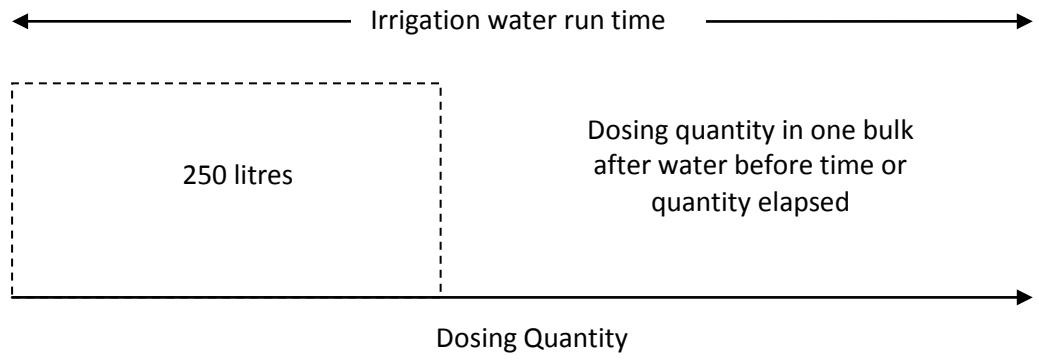
FIGURE 43. DOSING PROGRAM – BULK DOSING EXAMPLE

DOSING PROGRAM			
Program:	3		
INJECTION PER DOSING CHANNEL			
1	2	3	
PASSIV	PASSIV	PASSIV	
0.00	0.00	250	
Passive Dosing Method			QTY

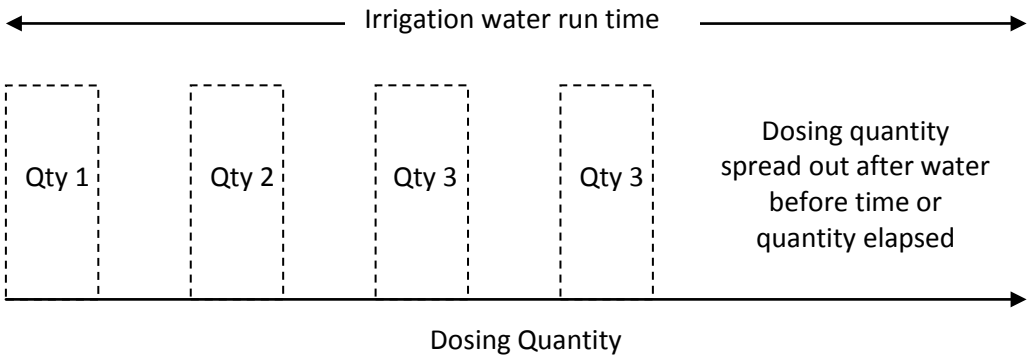
Dosing will be done in one **BULK** or **SPREAD** throughout the irrigation depending on the setting in **7.7 DOSING CONFIGURATION** for the line **Dosing by QTY.Method**.

FIGURE 44. DOSING – BULK VS. SPREAD

- **Bulk**



- **Spread**



From Example: Dosing Channel 3 = Qty 1 + Qty 2 + Qty 3 + Qty 4 + …… + Qty n = 250 litres

Example: EC Pre-Control for re-circulating drainage water from greenhouses

When collecting drainage water from greenhouses, the grower can re-circulate this water by setting an EC target before water goes through the irrigation system:

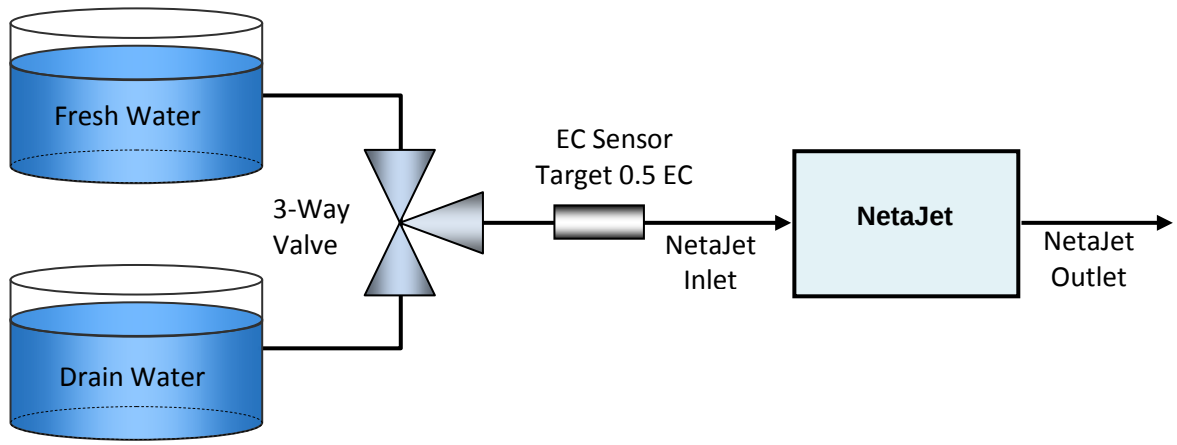
FIGURE 45. DOSING PROGRAM SCREEN - EC PRE-CONTROL EXAMPLE

DOSING PROGRAM			
Program:	2	EC Pre-Control:	ON
INJECTION PER DOSING CHANNEL			
1	2	3	
EC	EC	ACID	
4.50	5.50	5.00	
Target EC			1.80
Target pH			5.80
Target EC Pre-Control			0.5
EC Dosing Method			P.QTY
PH Dosing Method			P.QTY

NB

EC Pre-Control will only be available if the relevant outputs and inputs are defined under 8.Installation.

FIGURE 46. EC PRE-CONTROL SCHEMATIC



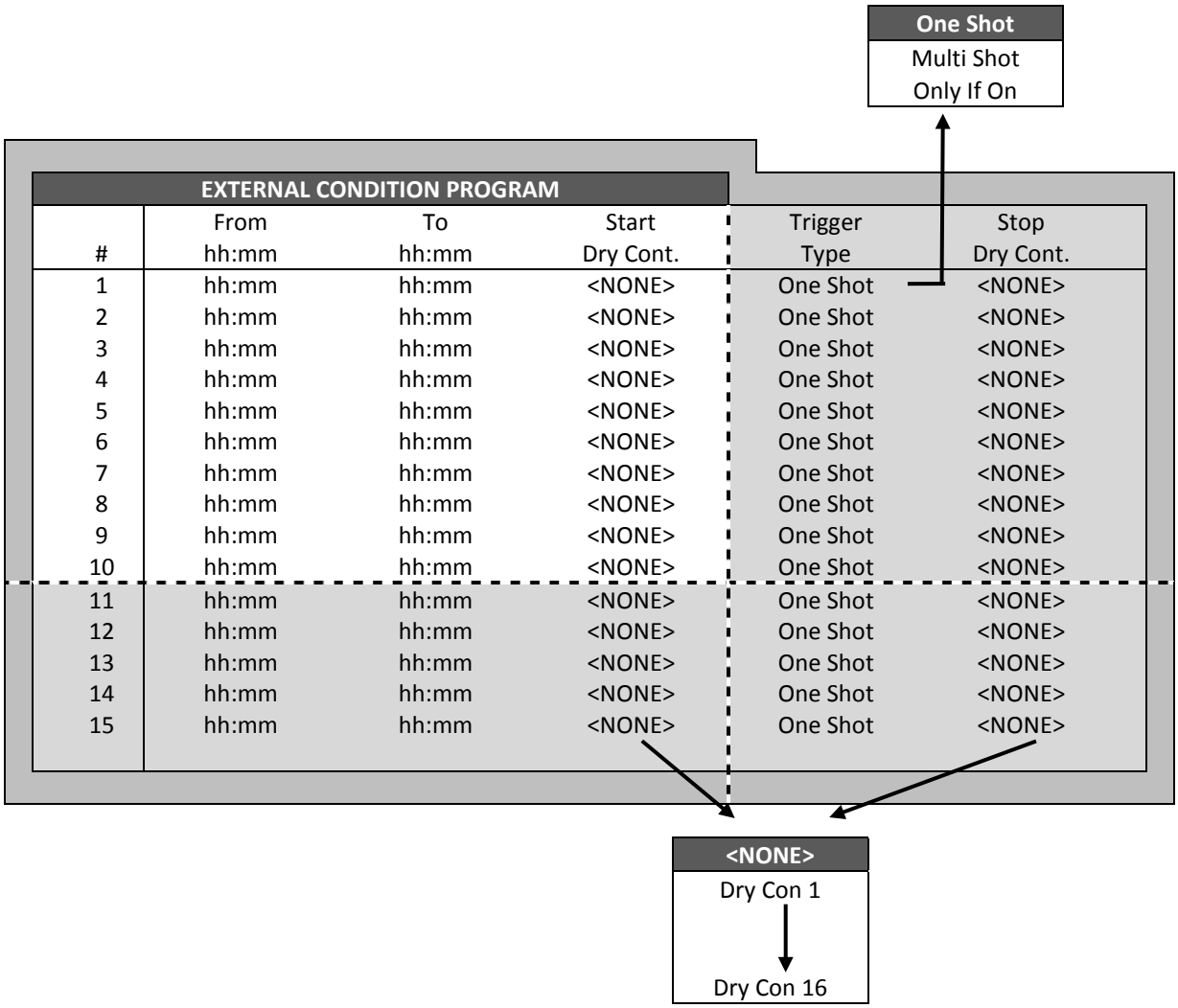
Example: System Nutrigation™ check EC / pH is on target

A detailed explanation on how to check that the EC / pH is on target is given in Section 5.5 *The Bucket Test.*

4.2.1.4 EXTERNAL CONDITION

The NMC Pro software includes 15 external condition programs. The external condition program allows starting and/or stopping irrigation according to dry contacts. In addition, it is possible to define an output called Condition. This output will be active whenever the condition program settings are met. This enables using the condition program to start any external device.

FIGURE 47. EXTERNAL CONDITION PROGRAM SCREEN



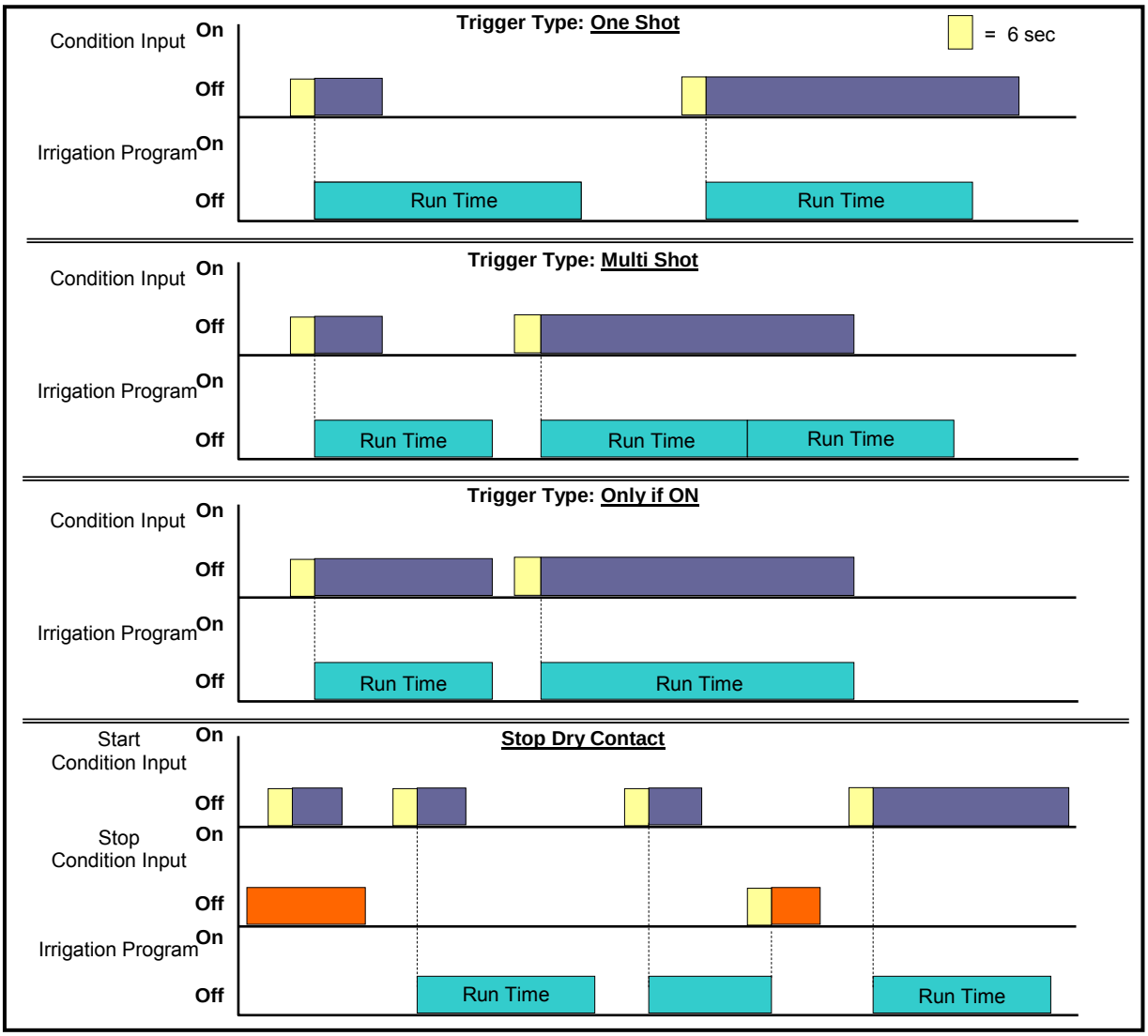
EXTERNAL CONDITION PROGRAM

- **# [Value in range 1 to 15]** – External condition program number.
- **From [Value in range 00:01 to 23:59]** – Set the start time of the condition program time frame.
- **To [Value in range 00:01 to 23:59]** – Set the end time of the condition program time frame.

NB	The condition program will only be operational in the defined time window (between start "From" to end "To" times). Each condition program can be operational on different hours. A closed contact will be regarded as an active contact.

- **Start Dry Contact [Value in range NONE or 1 to 16]** – Set the dry contact number for activating the condition program.
- **Trigger Type [Value in range One Shot, Multi Shot or Only If On]** – Choose one of three trigger types:
    - **One Shot** – If the start dry contact is closed for more than 6 seconds the associated condition program will be started. The contact must open and close to initiate the condition program. The run time for an irrigation program connected through this trigger will be according the water run time setup for this irrigation program.
    - **Multi shot** – If the start dry contact is closed for more than 6 seconds the associated condition program will be started. If the contact is still closed when the irrigation water run time has elapsed, the condition program will remain active and another irrigation cycle will be initiated. The start dry contact do not have to open and close in order to keep condition program active, it only needs to be closed when the irrigation water run time elapses. The minimum run time for an irrigation program connected through this trigger will be according the water run time setup for this irrigation program.
    - **Only If On** - If the start dry contact is closed for more than 6 seconds the associated condition program will be started. The condition program will remain active as long as the dry contact is closed.

FIGURE 48. EXAMPLES OF RUN TIMES FROM EXTERNAL CONDITIONS



Example: External condition program for storage tank filling

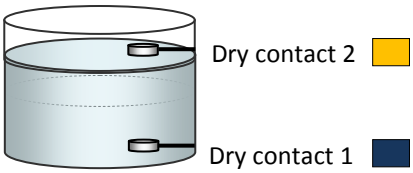


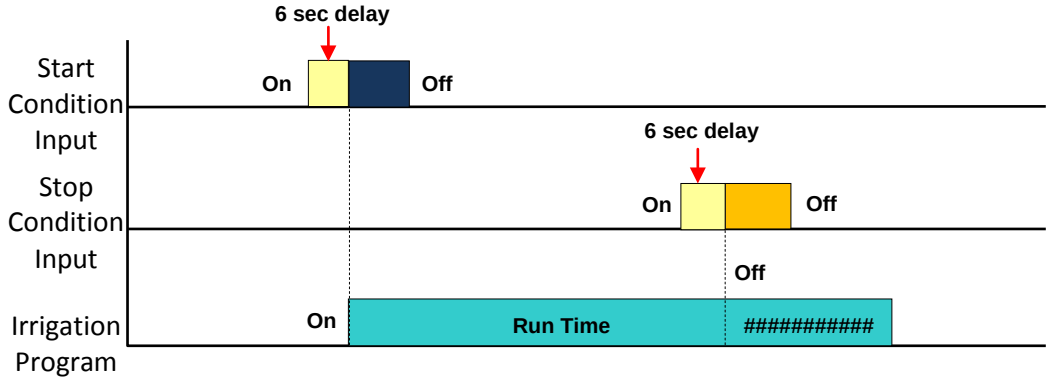
FIGURE 49. EXTERNAL CONDITION STORAGE TANK FILLING EXAMPLE

Dry contact 1 (Low Level Sensor) will start Condition Program 1 and Dry contact 2 (High Level Sensor) will stop Condition Program 1. Condition Program 1 is connected to Irrigation Program 3, please see Example: Irrigation based on External Condition (Dam Level).

FIGURE 50. EXTERNAL CONDITION PROGRAM SCREEN EXAMPLE

EXTERNAL CONDITION PROGRAM					
#	From hh:mm	To hh:mm	Start Dry Cont.	Trigger Type	Stop Dry Cont.
1	00:01	23:59	Dry Con 1	One Shot	Dry Con 2
2	--:--	--:--	<NONE>	One Shot	<NONE>
3	--:--	--:--	<NONE>	One Shot	<NONE>
4	--:--	--:--	<NONE>	One Shot	<NONE>
5	--:--	--:--	<NONE>	One Shot	<NONE>
6	--:--	--:--	<NONE>	One Shot	<NONE>
7	--:--	--:--	<NONE>	One Shot	<NONE>
8	--:--	--:--	<NONE>	One Shot	<NONE>
9	--:--	--:--	<NONE>	One Shot	<NONE>
10	--:--	--:--	<NONE>	One Shot	<NONE>

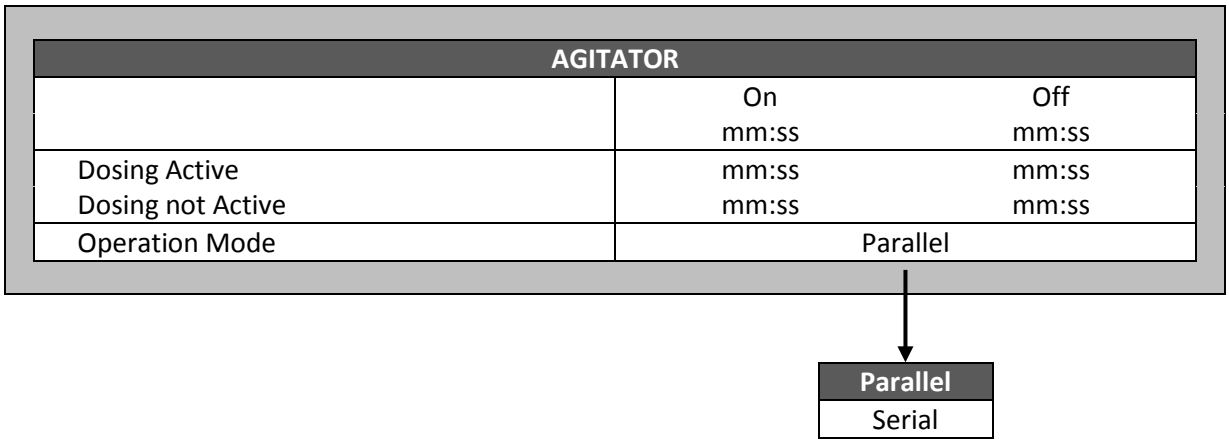
FIGURE 51. EXAMPLE OF RUN TIME BASED ON EXTERNAL CONDITION



4.2.1.5 AGITATOR

The agitator program is used to agitate the fertilizers and acid in the storage tanks in order to keep a constant concentration during the storage period. A maximum of three agitator outputs can be defined to be activated in parallel or serial operation.

FIGURE 52. AGITATOR SCREEN



AGITATOR

- **Dosing Active [Value in range 00:00 to 99:59]** – Definition of the on and off times of the agitator when dosing is taking place:
  - **On** – Define the required agitating time.
  - **Off** – Define the required rest time for agitators.
- Dosing not Active [Value in range 00:00 to 99:59] - Definition of the on and off times of the agitator when dosing is not taking place:
  - **On** – Define the required agitating time.
  - **Off** – Define the required rest time for agitators.
- Operation Mode [Value in range Parallel or Serial] – Define to operate agitators in parallel or serial mode:
  - **Parallel** – Agitators will be activated all at the same time.
  - **Serial** – Agitators will be activated one after the other and cycled according the on and off times set.

JR	In the NMC Junior, agitators only operate in parallel.

Example: Agitator program for storage tanks

FIGURE 53. AGITATOR PROGRAM EXAMPLE

AGITATOR		
	On mm:ss	Off mm:ss
Dosing Active Dosing not Active	05:00 05:00	20:00 90:00
Operation Mode	Serial	

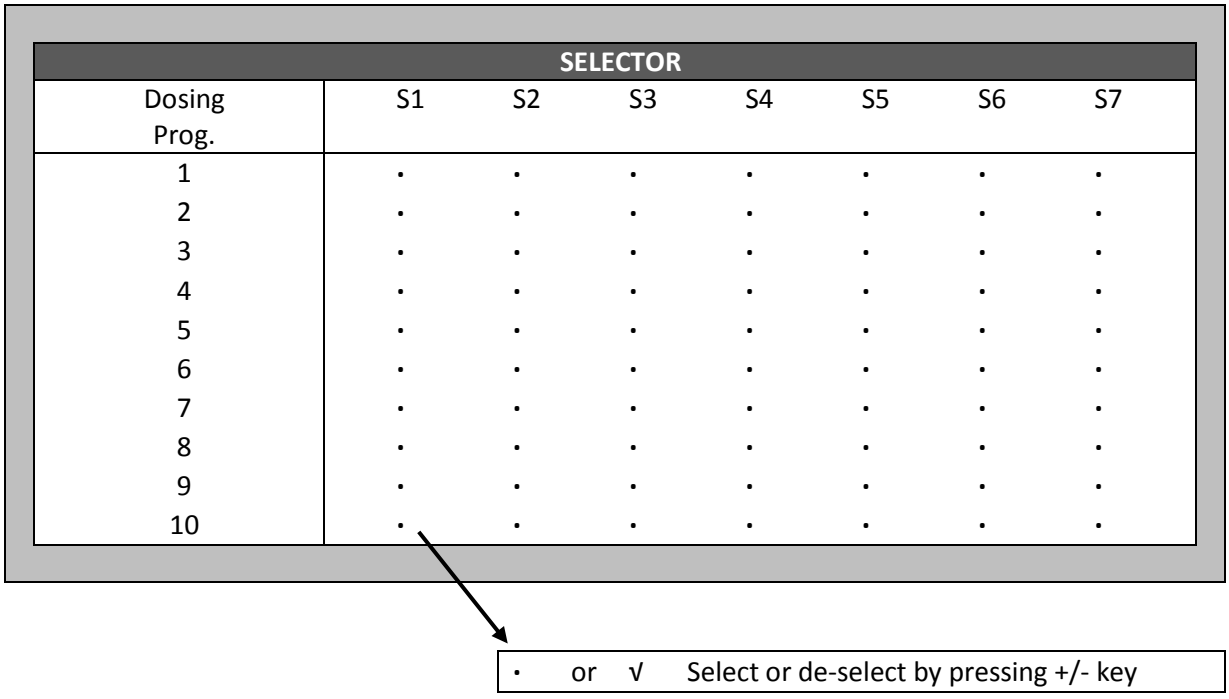
A Tank **B Tank** **C1 Tank**

4.2.1.6 SELECTOR

Enables the use of more than one fertilizer stock tank per dosing channel. Every dosing program can be connected to one or more selectors. Using the selector outputs you can choose which fertilizer stock tank will be connected to each dosing program. Maximum number of selectors is 7.

JR	The maximum number of selectors in the NMC Junior is 5.

FIGURE 54. FERTILISER SELECTOR SCREEN



SELECTOR

- **Dosing Program [Value in range 1 to 10]** – Dosing program number.
- **S1 to S7 [Value in range · or √]** – Select which selector must be turned on by which dosing program. To activate selector change · to √ by pressing +/- key at the appropriate position in the matrix.

Example: Selector program for storage tanks

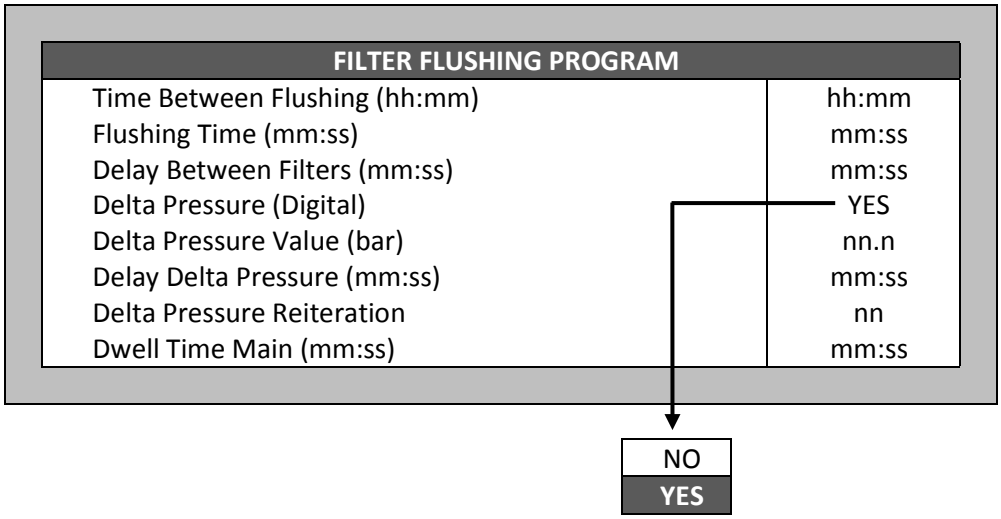
FIGURE 55. EXAMPLE OF SELECTOR PROGRAM FOR STORAGE TANKS

SELECTOR			
Dosing Prog.	S1	S2	S3
1	·	·	·
2	√	·	·
3	·	√	·
4	·	·	·
5	·	·	·
6	·	·	·
7	·	·	·
8	·	·	√
9	·	·	·
10	·	·	·

4.2.1.7 FILTER FLUSHING

The filter flushing program can control the cleaning of filters by back flushing of up to 24 filters in a battery type filtration system.

FIGURE 56. FILTER FLUSHING PROGRAM SCREEN



FILTER FLUSHING PROGRAM

- **Time Between Flushing [Value in range 00:00 or 99:59]** - Time interval between two consecutive flushing cycles. The time is only counted during irrigation. If the time between flushing is set to 01:00 it means that a flushing cycle will be activated after 1 hour of irrigation regardless of delta pressure switch status. If set to zero (--:--), flushing will only take place if triggered by a delta pressure switch.
- **Flushing Time [Value in range 00:00 or 99:59]** – Activated time of each filter back flush valve.
- **Delay Between Filters [Value in range 00:00 or 99:59]** - The delay time between one filter back flush valve closing to the next filter back flush valve opening. This time is usually used to allow pressure build up.
- **Delta Pressure [Value in range NO or YES]** – Define whether filter back flushing can be triggered by a digital delta pressure switch.
- **Delta Pressure Value [Value in range 0 to 10bar]** – Define the delta pressure of the inlet pressure sensor (P_{in}) and outlet pressure sensor (P_{out}) at which filter back flushing will be triggered (Only relevant when the application consists of analogue P_{in} and P_{out} sensors).
- **Delay Delta Pressure [Value in range 00:00 or 99:59]** – Define the time that the delta pressure (digital or value) must be relevant before a filter back flushing cycle will be triggered. This time is used to prevent unnecessary back flushing cycles from taking place.
- **Delta Pressure Reiteration [Value in range 0 to 99]** – Number of consecutive filter back flushing cycles triggered by the delta pressure that can take place. When this number of consecutive cycles are reached the NMC Pro will generate an alarm indicating that the delta pressure sensor is defective. The NMC Pro will then ignore the delta pressure and will continue flushing according to the set **Time Between Flushing** only, until the alarm is reset.
- **Dwell Time Main [Value in range 00:00 or 99:59]** – Define for what length of time the main filter valve must be activated before the filter back flushing cycle is started. This output is typically used to control a pressure-sustaining valve or to start a booster pump to build up pressure for the back flushing process.

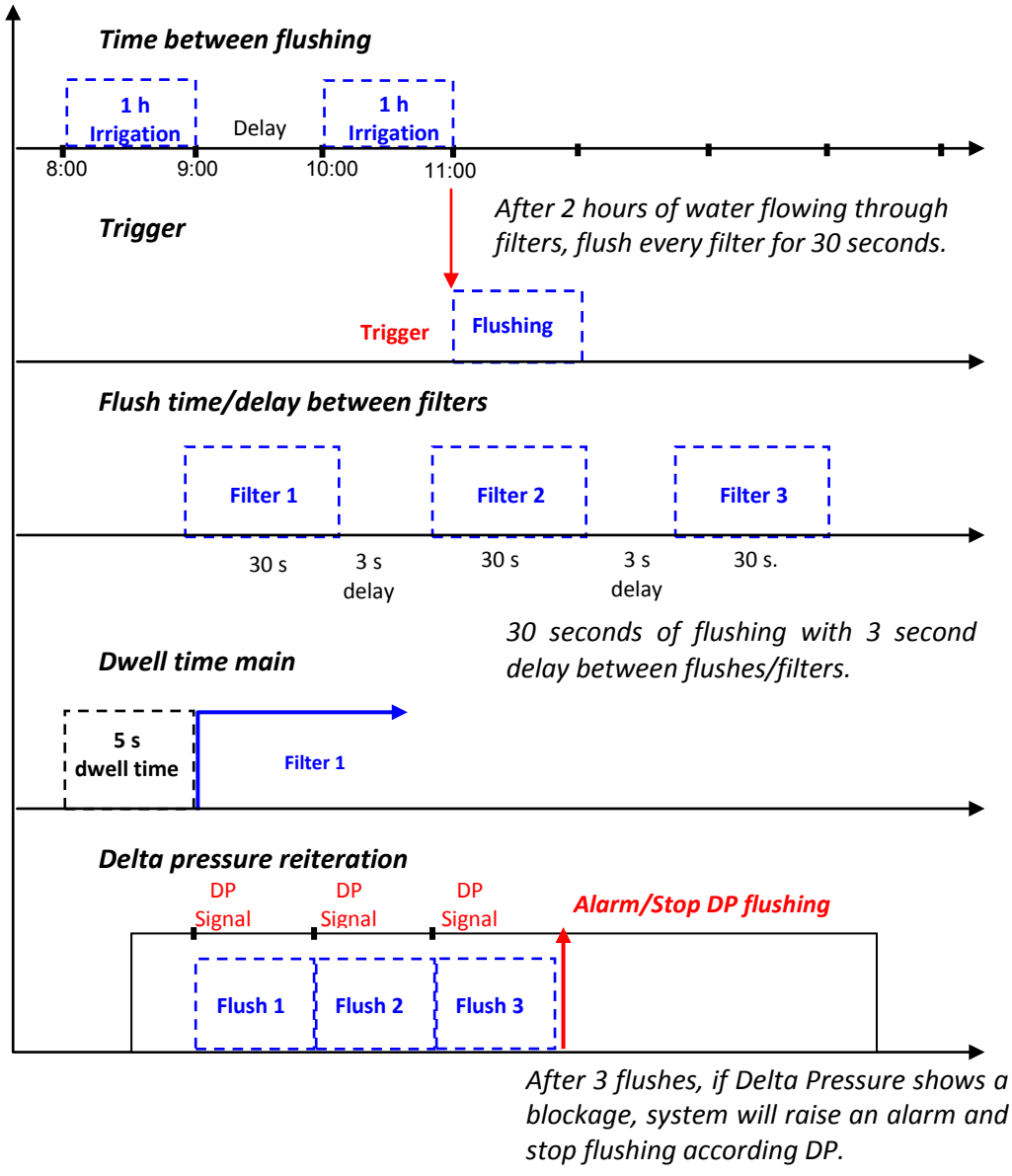
	After start up of an irrigation cycle automatic filter back flushing will not be possible until the Water Fill Up time in screen 3.3 ALARM DEFINITION has elapsed. This Water Fill Up time is applied after the start of each valve in the irrigation cycle.

Example: Filter Flushing Program for filter back flushing

FIGURE 57. FILTER FLUSHING PROGRAM SCREEN EXAMPLE

FILTER FLUSHING PROGRAM	
Time Between Flushing (hh:mm)	02:00
Flushing Time (mm:ss)	00:30
Delay Between Filters (mm:ss)	00:03
Delta Pressure (Digital)	YES
Delta Pressure Value (bar)	- - - -
Delay Delta Pressure (mm:ss)	00:10
Delta Pressure Reiteration	3
Dwell Time Main (mm:ss)	00:05

FIGURE 58. FILTER FLUSHING PROGRAM EXAMPLE



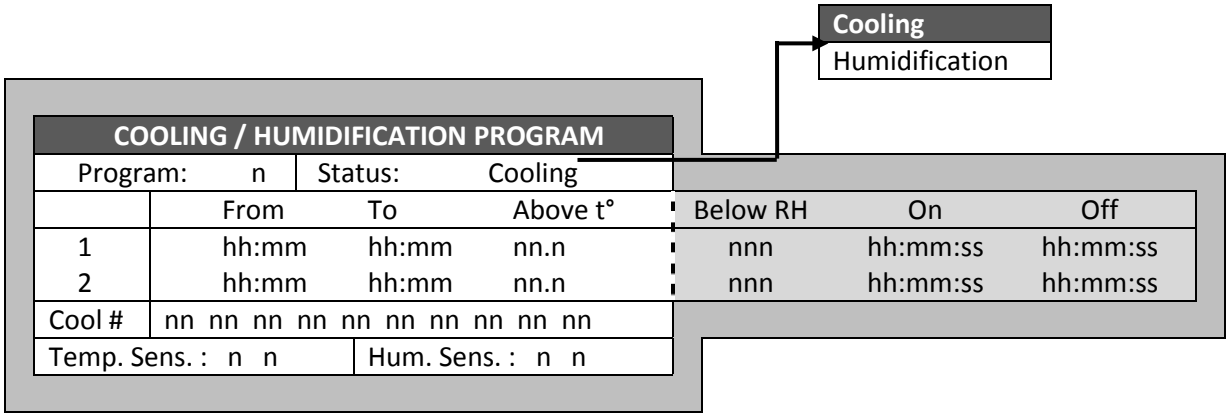
4.2.1.8 COOLING

Eight cooling programs are available with two programs (periods) in each program. The periods can be defined to overlap, thus creating dynamic cooling or humidification. Different temperature and humidity sensors can be connected to each program.

JR	There are five cooling programs in the NMC Junior. There are a maximum of two temperature sensors and one humidity sensor.

The cooling/humidification program is used to keep the temperature below a set value and/or the humidity above a set value. Each program can be set to maintain temperature or humidity as its first priority.
The status can be defined as cooling or humidification. The aim of the status field is to help the user to understand the process that should take place by placing the related set point first: 1) Above temperature when the status is cooling or 2) Below relative humidity when the status is humidification.

FIGURE 59. COOLING / HUMIDIFICATION PROGRAM SCREEN



COOLING / HUMIDIFICATION PROGRAM

- **Program [Value in range 1 to 8]** – Choose the required program 1 to 8, press **ENTER** to confirm.
- **Status [Value in range Cooling or Humidification]** – Define whether the programs first priority is maintaining temperature or humidity.
  - **Cooling** – The programs first priority is to maintain set temperature.
  - **Humidification** – The programs first priority is to maintain set humidity level.
- **Program Line 1 and 2** - Each cooling / humidification program has 2 program lines. A single line or both lines can be setup per program. When using both program lines there are two options for the program setup:
  - **Different time frames** – Two different time frames can be defined, each with its own start (from) and end (to) times. Each time frame can be setup with its own temperature and humidity levels.
  - **Overlapping time frames** – When overlapping time frames are setup for program lines 1 and 2 the program operation will be dynamic. The software will calculate and apply the on and off times between the programmed on and off times for the 2 program lines based on the measured temperature or humidity. This dynamic

operation will be controlled by measured temperature for cooling or measured humidity level for humidification.

- **From [Value in range 00:00 to 23:59]** – Set the start time of the cooling / humidification program.
- **To [Value in range 00:00 to 23:59]** – Set the end time of the cooling / humidification program.
- **For Status Cooling:**
  - **Above Temperature [Value in range 0 to 50]** - Start cooling above this temperature. Cooling will stop if the temperature drops below the set point minus internal dead-band of 0.5°C. For example: If set to 30°C cooling will start when the temperature is above 30°C and will stop when it drops below 29.5°C.
  - **Below Relative Humidity [Value in range 0 to 100]** - Start cooling below this humidity. Cooling will be stopped when the humidity level reaches the set point plus internal dead-band of 2%. For example: If set to 80% cooling will stop when the humidity is above 82% and will be resumed when the humidity drops below 80%.
- **For Status Humidification:**
  - **Below Relative Humidity [Value in range 0 to 100]** - Start humidification below this humidity. Humidification will stop if the humidity goes above the set point plus internal dead-band of 1%. For example: If set to 80% humidification will start when the humidity is below 80% and will stop when it is above 81%.
  - **Above Temperature [Value in range 0 to 50]** – Start humidification above this temperature. Humidification will stop if the temperature drops below the set point minus the internal dead-band of 0.5°C. For example: If set to 25°C humidification will stop when the temperature drops below 24.5°C and will be resumed when it goes above 25°C.
- **On [Value in range 00:00:00 to 99:59:59]** – Define the on time of the cooling valve. If on time is set to 00:00:00 the cooling valve or group will not be activated. If more than one cooling valve or group is defined there will be no delay between the cooling valves or groups as they work sequentially (see **Cool #** below).
- **Off [Value in range 00:00:00 to 99:59:59]** – Define the off time of the cooling valve. If off time is set to 00:00:00 the cooling valve or group will be constantly on. The off time is applied from the last activated cooling valve or group in the sequence (see **Cool #** below).
- **Cool # [Value in range 0 to 40, 10 cooling valves per program]** - Assign cooling valves to this program. The assigned cooling valves will be operated sequentially. The number of cooling programs which can be operated simultaneously is defined in line **Maximum Cooling Parallel** which can be found in screen **6.2 SYSTEM SETUP**.
- **Temperature Sensor [Value in range 0 to 8]** – Assign up to two temperature sensors per program.
- **Humidity Sensors [Value in range 0 to 8]** – Assign up to two humidity sensors per program.

	The temperature and humidity values used by a cooling program will be an average of the readings from the sensors connected to that cooling program. If there is a malfunction in one of the sensors, a message will be displayed, and that sensor will be taken out of the average sensor calculation. If all the temperature or humidity sensors are out of order the cooling program will not operate.

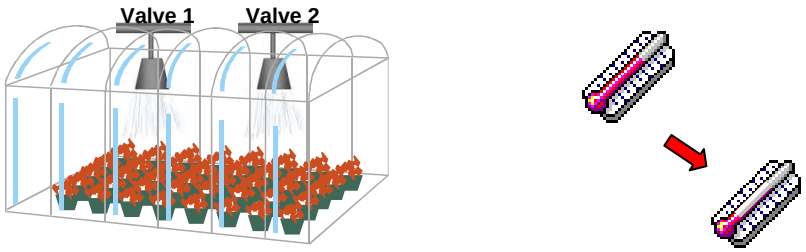
OPERATING A COOLING PROGRAM BY TIME ONLY

No temperature or humidity sensors must be defined as analogue inputs in order for a cooling program to run only on time. Dynamic operation of cooling program is also not possible:

- **Status** can be set to cooling or humidification.
- **From** (start) and **To** (end) times for cooling program must be set.
- Set the **Above temperature** and **Below relative humidity** to 0.
- Define the required **On** and **Off** times for the cooling valve or group.
- Next to **Cool #** define the cooling valves numbers connected to the cooling program.
- Do not define any **temperature** or **humidity** sensors for the cooling program.

Example: Cooling Program for greenhouse

FIGURE 60. COOLING PROGRAM IN GREENHOUSE EXAMPLE

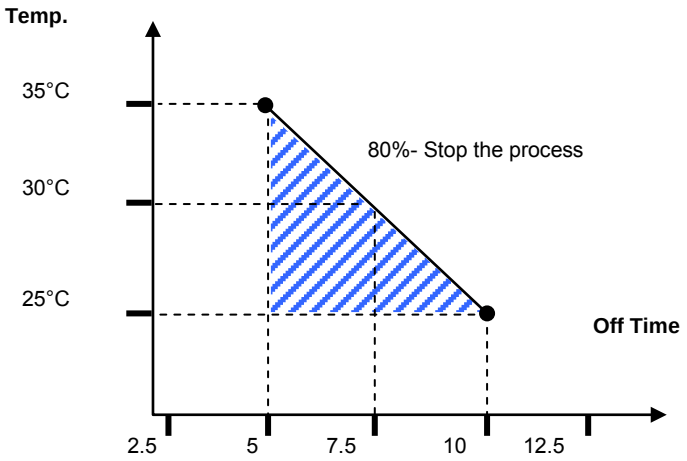


Dynamic cooling is required for the greenhouse from 08:00 to 16:00 for cooling valves 1 and 2. The valves on time is fixed on 10 seconds. At 25°C the valve off time must be 10sec and at 35°C the valve off time can be reduced to 5 seconds. Greenhouse humidity level cannot exceed 80%.

FIGURE 61. COOLING / HUMIDIFICATION PROGRAM SCREEN – GREENHOUSE EXAMPLE

COOLING / HUMIDIFICATION PROGRAM						
Program: 1	Status: Cooling					
	From	To	Above t°	Below RH	On	Off
1	08:00	16:00	25	80	00:00:10	00:00:10
2	08:00	16:00	35	80	00:00:10	00:00:05
Cool #	1 2 -- -- -- -- -- -- -- --					
Temp. Sens. : 1 2		Hum. Sens. : 1 2				

FIGURE 62. COOLING PROGRAM – GREENHOUSE EXAMPLE

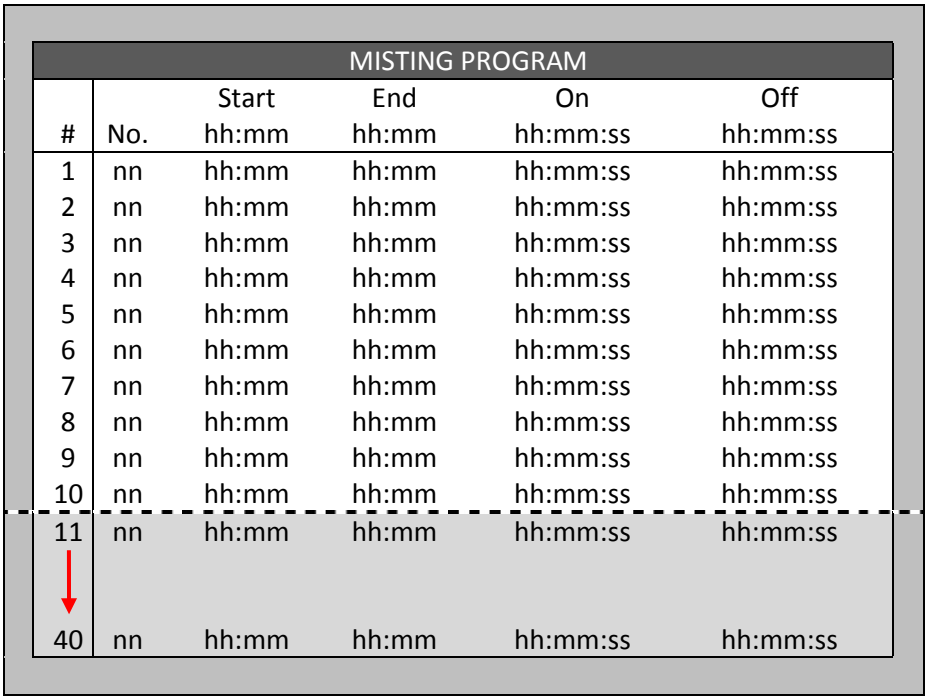


At 30°C greenhouse temperature and humidity < 80% the cooling valves on time will be 10s and off time will be 7.5s.

4.2.1.9 MISTING

The misting program is a time scheduler used to open/close a misting valve or any other device that is operated sequentially. Up to 40 misting programs can be programmed.

FIGURE 63. MISTING PROGRAM SCREEN



MISTING PROGRAM

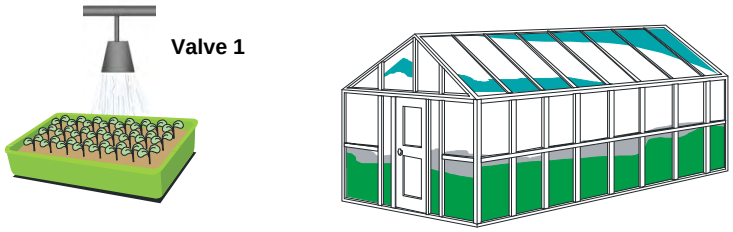
- **# [Value in range 1 to 40]** - Misting program number.
- **Number [Value in range 1 to 40]** – Assign a misting valve number to the program. It is possible to associate the same misting valve to several programs.
- **Start [Value in range 00:00 to 23:59]** – Set the start time of the misting program. If start time is set to 00:00, it will automatically be changed to --:--, meaning the program is not operational.
- **End [Value in range 00:00 to 23:59]** – Set the end time of the misting program. The misting program will only be operational in the defined time window (between Start to End times). Each misting program can be operational on different hours.
- **On [Value in range 00:00:00 to 99:59:59]** – Define the on time of the misting valve. If on time is set to 00:00:00 the misting valve will not be opened.
- **Off [Value in range 00:00:00 to 99:59:59]** – Define the off time of the misting valve. If off time is set to 00:00:00 the misting valve will be constantly on.

The misting program table is sorted according to misting valve number as the first priority and start time as the second priority. The misting valves will always appear in groups with an increasing order so that the orientation is quick and easy. Each misting group has an inside start time sorting, misting valves with a later start is moved to the end of the group. If you delete a row (by zeroing the misting valve number) it will be moved to the end of the table and the rest of the rows will move one step up. Pressing the MENU key does this sorting.

NB	When misting is on all related devices (misting valve, main valve and/or pump) are operational. When misting is off only the pump continues to operate.

Example: Misting Program for greenhouse

FIGURE 64. MISTING PROGRAM – GREENHOUSE EXAMPLE



Misting valve 1 is required to cycle on and off from 08:00 to 16:00. On for 5 seconds and off for 2 minutes 30 seconds.

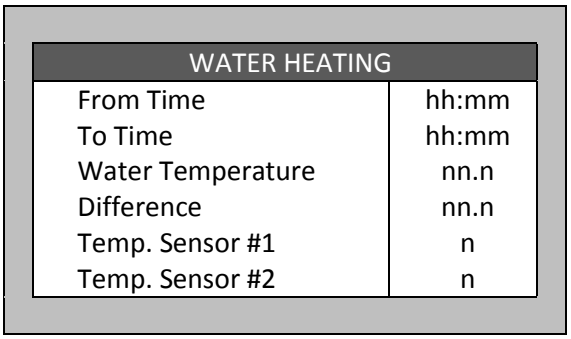
FIGURE 65. MISTING PROGRAM SCREEN – GREENHOUSE EXAMPLE

MISTING PROGRAM					
#	No.	Start hh:mm	End hh:mm	On hh:mm:ss	Off hh:mm:ss
1	1	08:00	16:00	00:00:05	00:02:30
2	--	--:--	--:--	--:--:--	--:--:--
3	--	--:--	--:--	--:--:--	--:--:--
4	--	--:--	--:--	--:--:--	--:--:--
5	--	--:--	--:--	--:--:--	--:--:--
6	--	--:--	--:--	--:--:--	--:--:--
7	--	--:--	--:--	--:--:--	--:--:--
8	--	--:--	--:--	--:--:--	--:--:--
9	--	--:--	--:--	--:--:--	--:--:--
10	--	--:--	--:--	--:--:--	--:--:--

4.2.1.10 WATER HEATING

Water heating operates according to temperature within a set time frame and can be used to increase irrigation water temperature or prevent frost. One water heating program and output is available.

FIGURE 66. WATER HEATING SCREEN



WATER HEATING

- **From Time [Value in range 00:00 to 23:59]** – Set the start time of the water heating program.
- **To Time [Value in range 00:00 to 23:59]** – Set the end time of the water heating program.
- **Water Temperature [Value in range -20°C to 50°C]** – Water heating will be activated when the measured temperature drops below this value.
- **Difference [Value in range 0.3°C to 20°C]** – Dead band for stopping water heating. When the measured water temperature reaches the set water temperature + difference water heating will be stopped.

  ***For example**:* Water temperature is set at 25°C and the difference set at 2°C. Water heating will start when the temperature drops below 25°C and will stop when it is 27°C or above. The Minimum difference is 0.3°C and the default is 0.5°C.

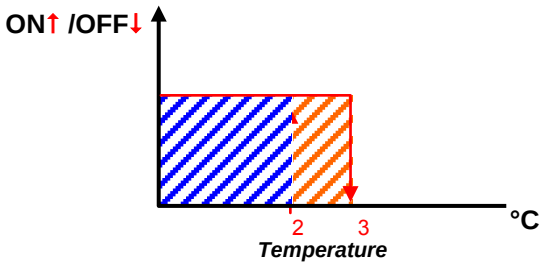
- **Temperature Sensor #1 / 2 [Value in range 0 to 8]** – Assign up to 2 temperature sensors to the water heating program. If 2 sensors are assigned the water heating program will use the average reading between the sensors.

Example: Water Heating for frost control

It is required from 04:00 until 07:00 every morning to activate the frost control system when the temperature drops below 2°C. Frost control can stop if the temperature increases to 5°C. Temperature sensors number 3 and 4 measures outside temperature.

FIGURE 67.WATER HEATING EXAMPLE

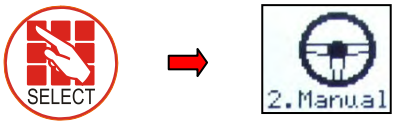
WATER HEATING	
From Time	04:00
To Time	07:00
Water Temperature	2
Difference	3
Temp. Sensor #1	3
Temp. Sensor #2	4



4.2.2 MANUAL

In the **MAIN MENU** screen place the cursor on the manual icon and press ENTER, or press "2" to enter the **2. MANUAL OPERATION** menu.

FIGURE 68. MANUAL OPERATION SCREEN

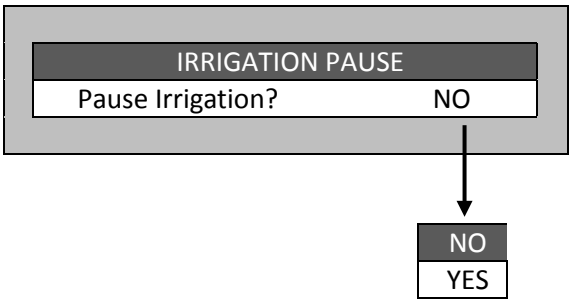


MANUAL OPERATION	
1.	**IRRIGATION PAUSE**
2.	START/STOP PROGRAM
3.	START/STOP VALVE
4.	FILTER FLUSHING

4.2.2.1 IRRIGATION PAUSE

Manually pause the system during an active irrigation program to calibrate EC/pH probes, fix leaks, etc.

FIGURE 69. IRRIGATION PAUSE SCREEN

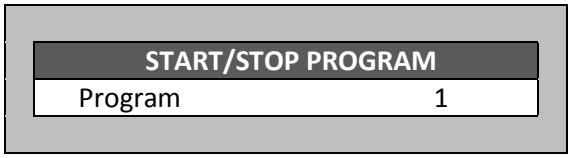


- **Pause Irrigation? [Value in range NO or YES]** – Set **YES** and press **ENTER** to confirm: All irrigations will be paused until the value will be set back to **NO.** When the system is released from Pause mode it will complete all irrigations that should have taken place while it was paused.

4.2.2.2 START/STOP PROGRAM

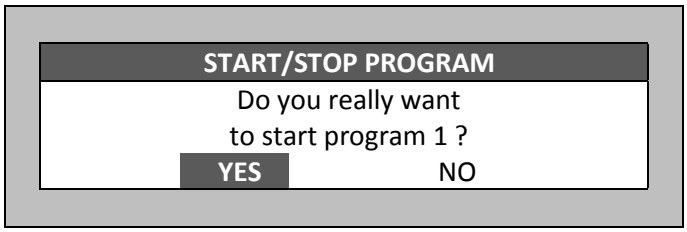
Manually start or stop an irrigation program.

FIGURE 70. START/STOP PROGRAM NUMBER



- Type a program number to start manually and confirm by pressing **ENTER**, this will open the confirmation screen.

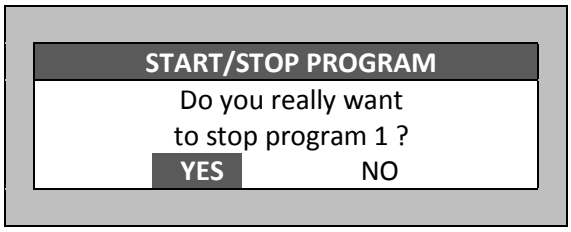
FIGURE 71. START CONFIRMATION



- Select **YES** to confirm your choice and start the relevant program.

When you enter the start/stop program screen during an active irrigation you will be asked whether you wish to stop the active program.

FIGURE 72. STOP CONFIRMATION

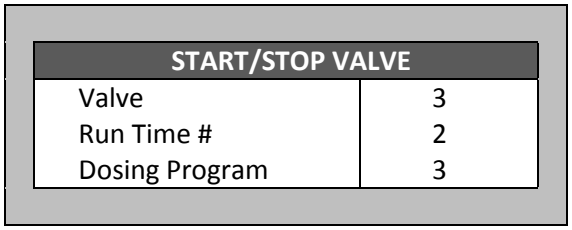


- Choose **YES** to stop the program.

4.2.2.3 START/STOP VALVE

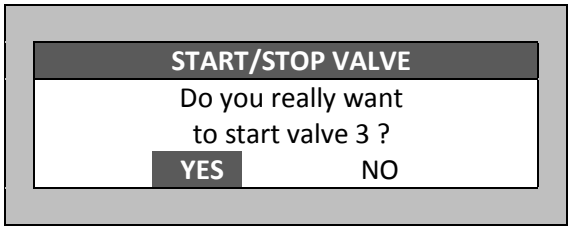
Manually start or stop an irrigation valve.

FIGURE 73. START/STOP VALVE SCREEN



- Enter a valve number, water run time number and dosing program number (optional), press **ENTER** to confirm numbers and then press **MENU** to open the confirmation screen.

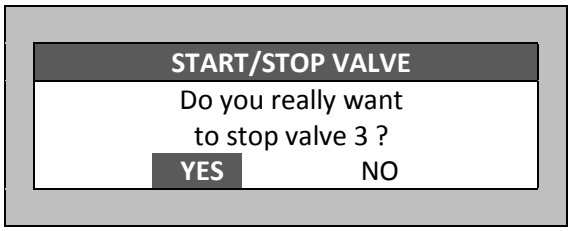
FIGURE 74. VALVE START CONFIRMATION



- Select **YES** if you wish to start the relevant valve.

When you enter the start/stop valve screen during an active irrigation you will be asked whether you wish to stop the active valve.

FIGURE 75. VALVE STOP CONFIRMATION

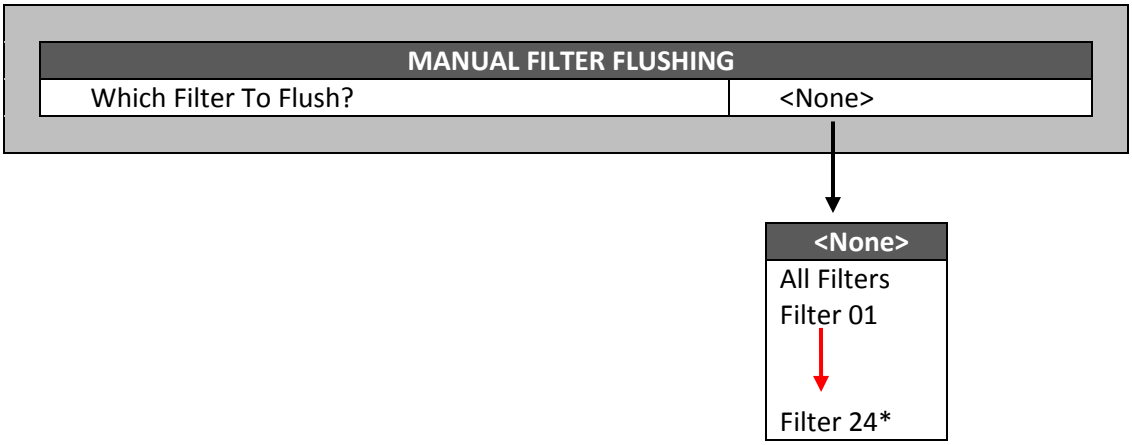


- Choose **YES** to stop the valve.

4.2.2.4 FILTER FLUSHING

Manually start a filter back flushing sequence.

FIGURE 76. MANUAL FILTER FLUSHING SCREEN



Select which filter to flush and press **ENTER** to confirm. You can flush individual filters or all filters (all filters setup and flushed one after the other). Manual filter back flushing can be started only during an active irrigation cycle as it cannot activate the irrigation system pump.

NB	Manual filter back flushing will not be possible until the Water Fill Up time in screen 3.3 ALARM DEFINITION has elapsed. This Water Fill Up time is applied after the start of each valve in the irrigation cycle.

JR	*The NMC Junior is limited to 15 filters.

4.2.3 ALARM

In the **MAIN MENU** screen place the cursor on the alarm icon and press **ENTER**, or press "**3**" to enter the **3.ALARM** menu.

FIGURE 77. ALARM MENU SCREEN

ALARM	
1.	**ALARM RESET**
2.	HISTORY
3.	ALARM DEFINITION
4.	ALARM SETTING
5.	EC/pH ALARM DEFINITION*
6.	EC/pH ALARM SETTING*

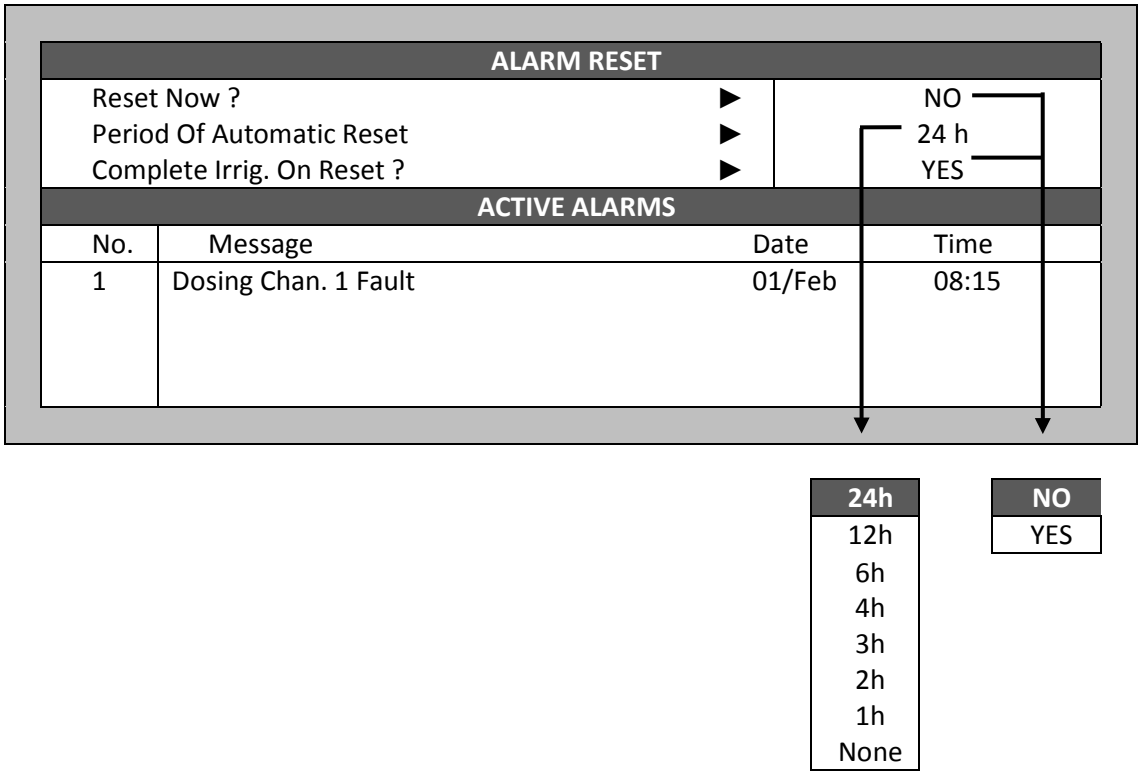
The alarm menu allows reset of active alarms, history of previous alarms, configuration of alarms and alarm actions. The alarm menu is divided into non EC/pH related alarms and EC/pH related alarms.

JR	*These alarms are not available in the NMC Junior.

4.2.3.1 ALARM RESET

This screen shows active alarms and failures. The upper section allows you to cancel failures and reset alarms. The lower section displays active alarm information.

FIGURE 78. ALARM RESET SCREEN



ALARM RESET

- **Reset Now? [Value in range NO or YES]** – Choose NO or YES to reset current alarm.
- **Period Of Automatic Reset [Value in range 24h, 12h, 6h, 4h, 3h, 2h, 1h or None]** – Set a time in which the NMC Pro will automatically reset the active alarms and attempt to complete the uncompleted processes.
- **Complete Irrig. On Reset? [Value in range NO or YES]** – Choose to complete or not complete an irrigation cycle that was halted due to an active alarm.

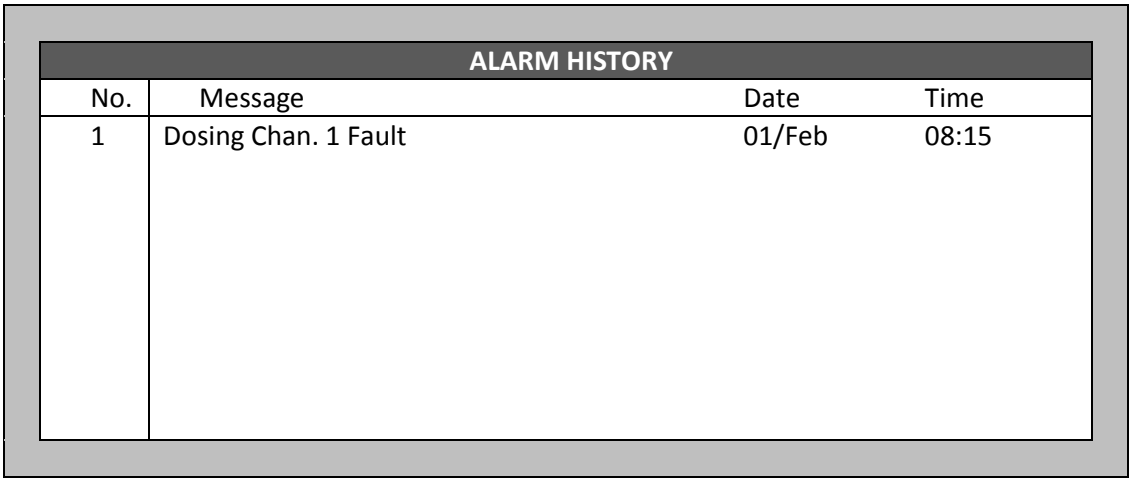
ACTIVE ALARMS

- **Number** – Active alarm number.
- **Message** – Active alarm description.
- **Date** – Date alarm was generated.
- **Time** – Time alarm was generated.

4.2.3.2 HISTORY

A record of every alarm reset are kept in this screen, up to 250 records (lines).

FIGURE 79. ALARM HISTORY SCREEN



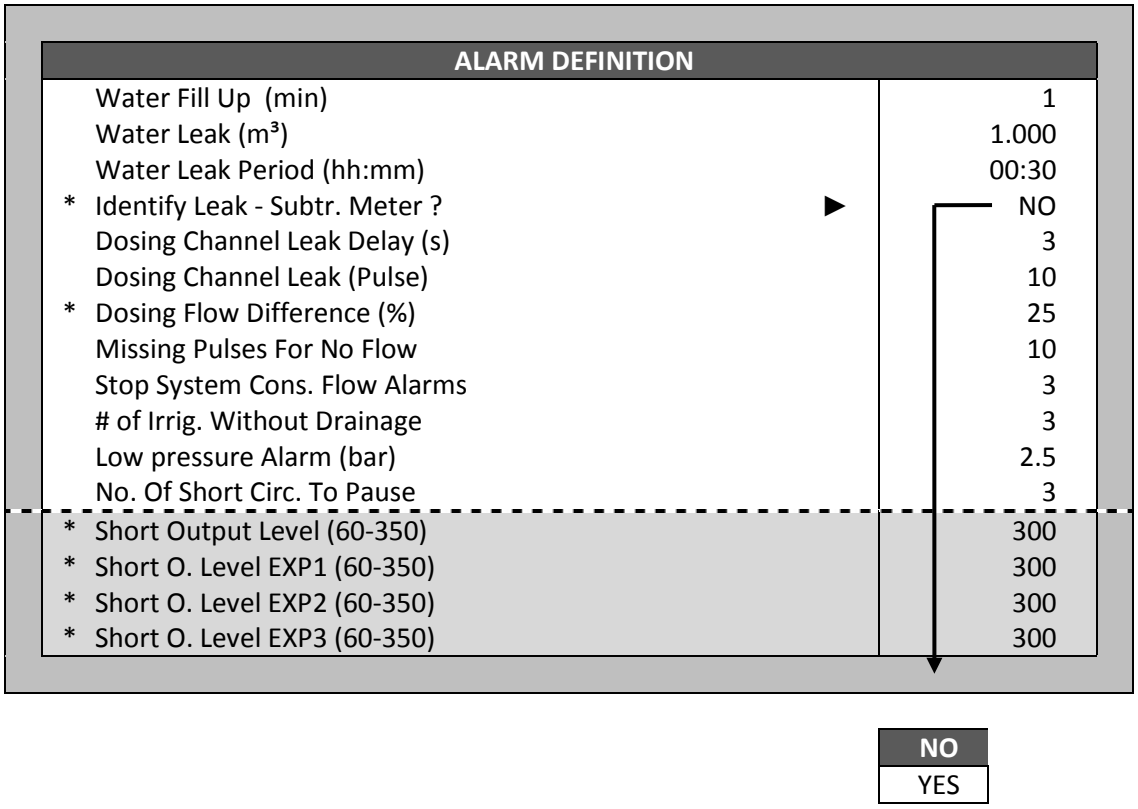
ALARM HISTORY

- **Number** – Alarm record number.
- **Message** – Alarm record description.
- **Date** – Date alarm was generated.
- **Time** – Time alarm was generated.

4.2.3.3 ALARM DEFINITION

This screen is for the configuration of certain alarm functions.

FIGURE 80. ALARM DEFINITION SCREEN



JR	*These features are not available in the NMC Junior.

ALARM DEFINITION

- **Water Fill Up [Value in range 0 to 99]** - Time for pipeline fill up. The system will ignore high flow and will not generate a high flow alarm during this period. This Water Fill Up time is applied after the start of each valve in the irrigation cycle.
- **Water Leak [Value in range 0 to 9999.99]** - Quantity of water that must be measured by the water meter, when an irrigation cycle is not active, that will trigger a water leak alarm.
- **Water Leak Period [Value in range 00:00 to 23:59]** - Time period to measure the water leak quantity above If it takes the system longer than indicated here, to measure the water leak quantity, the alarm will not be generated.
- ***Identify Leak Subtracting Meter? [Value in range NO or YES]** – Choose to identify or not identify a water leak from a subtracting water meter (relevant only when operating by water meter type water source in menu screen **7.5 WATER METER**).
- **Dosing Channel Leak Delay [Value in range 0 to 99]** – Delay after dosing channels are stopped before the system starts measuring for dosing channel leaks. This feature is usually used to cope with problems regarding hydraulic pumps that work with dosing meters.

- **Dosing Channel Leak [Value in range 0 to 99]** - Number of pulses measured from the dosing meter when the dosing channel should be idle before the system will generate a dosing leak alarm.
- ***Dosing Flow Difference [Value in range 0 to 99]** – Percentage difference from calculated dosing channel flow above or below which an alarm will be generated. For example: If the calculated dosing channel flow is 100l/h and the dosing flow difference of 25%, an alarm will be generated when the actual flow measured is less than 75l/h or above 125l/h.
- **Missing Pulses For No Flow [Value in range 0 to 99]** – Number of missing pulses from the water meter before the system will generate a no flow alarm. The system calculates the expected time between pulses from the set flow rate and the pulse rate of the water meter. If more time has passed than expected for the set number of missing pulses the system will generate a no flow alarm.
- **Stop System Consecutive Flow Alarms [Value in range 0 to 99]** – Number of consecutive flow alarms of the same type (high flow, low flow and no flow) from different valves or valve groups before the system is stopped. This setting is used to pause the system when there is a general malfunction that occurs in a few valves or valve groups.
- ***Number of Irrigations Without Drainage [Value in range 0 to 99]** – Number of irrigations given without measuring drainage, above which an alarm will be generated. This alarm usually indicates that the irrigation quantity is too small or that there is a malfunction in the drainage measurement.
- ***Low Pressure Alarm [Value in range 0 to 10bar]** – Define the minimum allowed irrigation system pressure under which an alarm will be generated.
- ***Number of Short Circuits To Pause [Value in range 0 to 99]** – Number of short circuit alarms detected before the system is paused. This setting is used to pause the system when a general malfunction occurs causing several outputs to short circuit.
- ***Short Output Level [Value in range 0 or 60 to 350]** – Set the threshold value to be considered as a short circuit (see setting short circuit threshold level below).
- *The following parameters will be visible only if expansion boxes are defined:*
- ***Short Output Level Expansion Box 1 [Value in range 0 or 60 to 350] -** Set the threshold value for expansion box 1 to be considered as a short circuit (see setting short circuit threshold level below).
- ***Short Output Level Expansion Box 2 [Value in range 0 or 60 to 350] -** Set the threshold value for expansion box 2 to be considered as a short circuit (see setting short circuit threshold level below).
- ***Short Output Level Expansion Box 3 [Value in range 0 or 60 to 350] -** Set the threshold value for expansion box 3 to be considered as a short circuit (see setting short circuit threshold level below).

JR	*The NMC Junior does not feature these alarm definitions.

Setting Short Circuit Threshold Level

JR	This feature is not available in the NMC Junior.

- In menu screen **5.1 RELAYS** manually operate the maximum amount of devices to be used simultaneously (maximum output load expected).
- Observe the value displayed to the right of the last line **Load Output Level (A/D)** in menu screen **5.1 RELAYS**. Calculate the desired threshold level as follows:

TABLE 4. SHORT CIRCUIT THRESHOLD SET VALUES

Observed A/D level	For set value	Notes
0 to 60	Add 30	Do not set a value less than 60
60 to 300	Add 50%	If upper limit of 350 is exceeded, use external power source
Above 300	Use external power source (consult Netafim technician)	

- Use the calculated value to set the **Short Output Level** in menu screen **3.3 ALARM DEFINITION** for the **Local** and **Expansion Boxes** if connected.
- To disable **Short Output Level** set the value to 0.

JR	In addition to the list in FIGURE 80, the NMC Junior lists the following alarm definitions in Sub-menu 3.3 that are listed elsewhere, in Sub-menu 3.5 in the NMC Pro: • Delta EC Low • Delta EC High • Delta pH Low • Delta pH High See Section 4.2.3.5 for their descriptions.

4.2.3.4 ALARM SETTING

The alarm setting table allows you to define the required response to failures recognized by the NMC Pro controller.

FIGURE 81.ALARM SETTING SCREEN

	ALARM SETTING				
	Description	Irri.	Dose	Delay mm:ss	Alarm Active
	High Flow	STOP	STOP	01:00	YES
	Low Flow	STOP	STOP	01:00	YES
	No Flow	STOP	STOP	- - - - -	YES
	D. Ch. Leak	CONT.	STOP	30:00	YES
	D. Ch. Fault	CONT.	STOP	01:00	YES
	Ext. Pause	PAUSE	IRRIG.	00:30	YES
*	D.Boos.Prot.	STOP	STOP	01:00	YES
*	Low Pressure	STOP	STOP	01:00	YES
	R.U. Error	STOP	STOP	01:00	YES
	R.U. Comm F.	STOP	STOP	01:00	YES

ALARM SETTING

- **Description**
  - **High Flow** – Measured irrigation system flow rate exceeds the set maximum flow rate, also see menu screen 7.4 VALVE FLOW RATE.
  - **Low Flow** – Measured irrigation system flow rate is less than the set minimum flow rate, also see menu screen 7.4 VALVE FLOW RATE.
  - **No Flow** – No flow in the irrigation system has been registered. Delay setting not allowed for no flow alarm.
  - **Dosing Channel Leak** – Flow through the dosing channel/s have been registered when the channel/s are closed.
  - **Dosing Channel Fault** - Flow through the dosing channel/s have not been registered when the channel/s are opened.
  - **External Pause** – The external pause alarm is used to pause the system through a digital input. This alarm can be activated by any external digital sensor (flow no flow switch, pressure switch, etc.). The action applied from an external pause alarm to the irrigation and dosing processes cannot be changed from PAUSE IRRIGATION.
  - ***Dosing Booster Protection** – This alarm is used to protect the dosing booster pump through a digital input. This alarm can be activated by any external digital sensor but normally a pressure switch is used.
  - ***Low Pressure** – With pressure sensors (transducers) connected to the NMC Pro the irrigation system pressure can be monitored. In menu screen 3.3 ALARM DEFINITION line Low pressure Alarm (bar) the pressure value for this alarm can be set.
  - **Remote Unit Error** – Error detected on single cable remote unit or radio unit.
  - **Remote Unit Communication Failure** – Communication failure with remote unit, communication lost with single cable remote unit or radio unit.

- **Irrigation and Dosing [Value in range STOP or CONTINUE]** – Action applied to processes.
    - **STOP** – Stop irrigation and/or dosing for the current valve (or valve group) and continue to the next valve (or valve group).
    - **CONTINUE** – Continue irrigation and/or dosing for the valve (or valve group) that caused the alarm. This option means that the system will register an alarm but will not take action.
- **Delay [Value in range 00:00 to 99:59]** – Define the period that the failure must be active before the NMC Pro will register an alarm and take action.
- **Alarm Active [Value in range No or Yes]** – Define whether the alarm output should be triggered by the corresponding alarm.

An alarm will be generated on the NMC Pro even if the alarm settings are set to continue the process and/or the alarm output has been set to not active.

	*The NMC Junior does not feature these alarm settings. In addition to the list in FIGURE 81, the NMC Junior lists the following alarm settings in Sub-menu 3.4 that are listed elsewhere, in Sub-menu 3.6 in the NMC Pro: • EC High/Fail • EC Low • pH High • pH low/Fail See Section 4.2.3.6 for their descriptions.

4.2.3.5 EC/pH ALARM DEFINITION

Use this screen to set EC and pH alarm threshold values.

FIGURE 82. EC/pH ALARM DEFINITION SCREEN

	EC/pH ALARM DEFINITION	
*	Delta EC Low	0.5
*	Delta EC High	0.5
*	Delta pH Low	0.5
*	Delta pH High	0.5
	Delta EC - Pre Control Low	0.5
	Delta EC - Pre Control High	0.5
	Emergency EC High (1 Min. Dly)	4.0
	Emergency pH Low (1 Min. Dly)	4.5

*The NMC Junior does not feature Sub-menu 3.5 EC/pH ALARM DEFINITION. However these features asterisked in FIGURE 80 are handled in 3.3 ALARM DEFINITION.

EC/pH ALARM DEFINITION

- ***Delta EC Low [Value in range 0.2 to 99.0]** – If the measured EC value is lower than the set value minus delta EC low the system will generate a **Low EC Alarm**.
- ***Delta EC High [Value in range 0.2 to 99.0]** – If the measured EC value is higher than the set value plus delta EC high the system will generate a **High EC Alarm**.
- ***Delta pH Low [Value in range 0.2 to 99.0]** – If the measured pH value is lower than the set value minus delta pH low the system will generate a **Low pH Alarm**.
- ***Delta pH High [Value in range 0.2 to 99.0]** – If the measured pH value is higher than the set value plus delta pH high the system will generate a **High pH Alarm**.
- **Delta EC Pre-Control Low [Value in range 0.2 to 99.0]** – If the measured EC pre-control value is lower than the set value minus delta EC pre-control low the system will generate a **Low EC Pre-Control Alarm**.
- **Delta EC Pre-Control High [Value in range 0.2 to 99.0]** – If the measured EC pre-control value is higher than the set value plus delta EC pre-control high the system will generate a **High EC Pre-Control Alarm**.
- **Emergency EC High (1 Minute Delay) [Value in range 0 to 99.0]** – If the measured EC is higher than the value set here for more than 1 minute the system will be stopped. This setting should be used to protect the plants and should generally be higher than the EC high alarm.
- **Emergency pH Low (1 Minute Delay) [Value in range 0 to 99.0]** – If the measured pH is lower than the value set here for more than 1 minute the system will be stopped. This setting should be used to protect the plants and should generally be lower than the pH Low alarm.

4.2.3.6 EC/pH ALARM SETTING

The EC/pH alarm setting table allows you to define the required response to EC and pH failures recognized by the NMC PRO.

FIGURE 83. EC/pH ALARM SETTING SCREEN

	EC/pH ALARM SETTING				
	Description	Irri.	Dose	Delay mm:ss	Alarm Active
*	EC High / Fail	CONT.	STOP	01:00	YES
*	EC Low	CONT.	STOP	01:00	YES
*	pH High	CONT.	STOP	01:00	YES
*	pH Low / Fail	CONT.	STOP	01:00	YES
	EC - P. Hi / Fail	STOP	STOP	01:00	YES
	EC - Pre. Low	STOP	STOP	01:00	YES
	E. Tank Fresh	STOP	STOP	01:00	YES
	E. Tank Drain	STOP	STOP	01:00	YES
	EC Sen. Dif.	CONT.	STOP	01:00	YES
	pH Sen. Dif	CONT.	STOP	01:00	YES

*The NMC Junior does not feature Sub-menu 3.6 EC/pH ALARM SETTING. However these features asterisked in FIGURE 83 are handled in 3.4 ALARM SETTING.

EC/pH ALARM SETTING

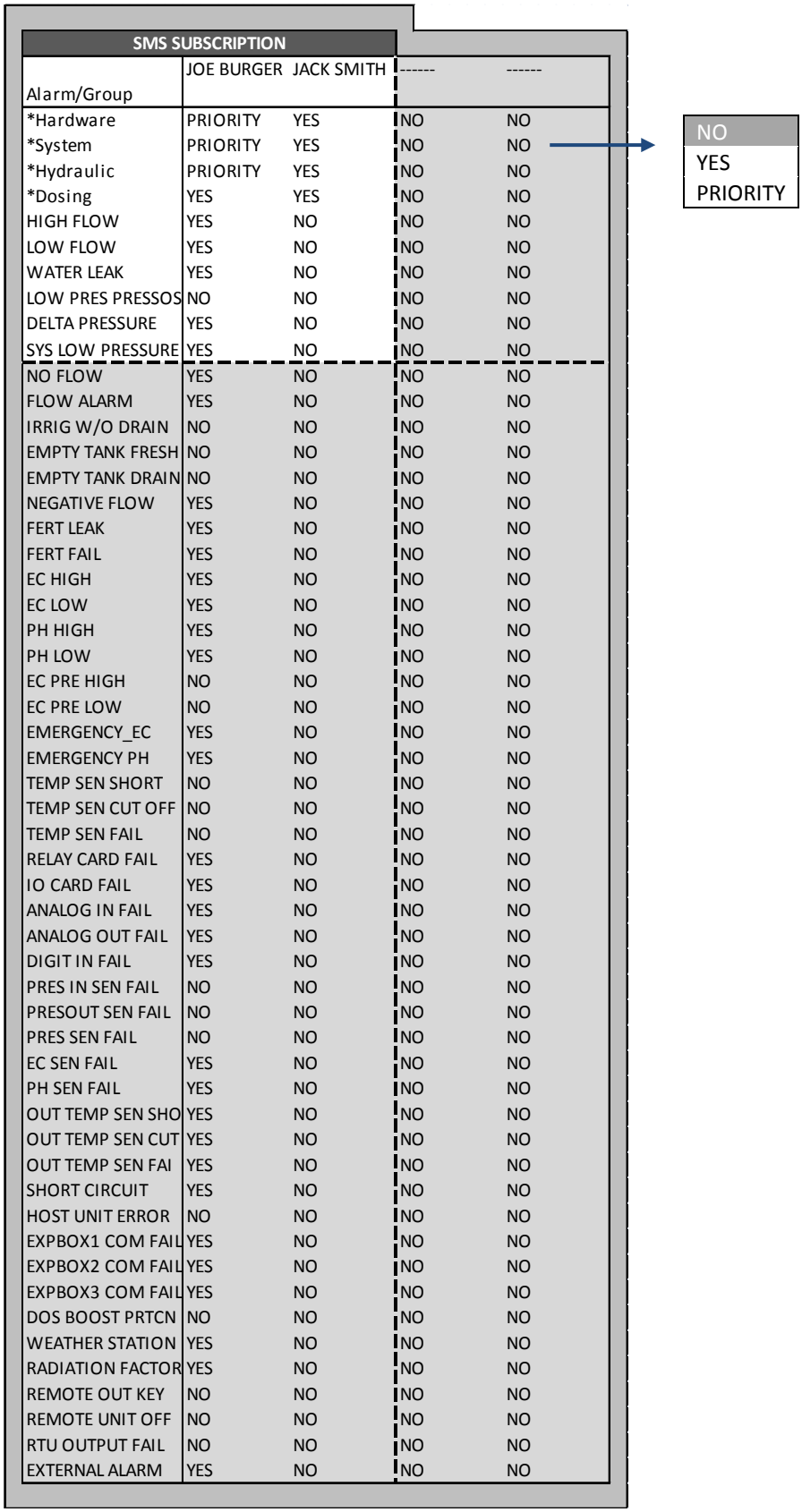
- **Description**
  - ***EC High/Fail** – Measured EC exceeds the set maximum or the EC probe is faulty.
  - ***EC Low** – Measured EC is lower than the set minimum.
  - ***pH High** – Measured pH exceeds the set maximum.
  - ***pH Low/Fail** – Measured pH is lower than the set minimum or the pH probe is faulty.
  - **EC - Pre Control High/Fail** – Measured pre control EC exceeds the set maximum or the EC pre control probe is faulty.
  - **EC - Pre Control Low** – Measured pre control EC is lower than the set minimum.
  - **Empty Tank Fresh** – The fresh water reservoir is empty. This alarm is generated through the digital input Fresh Tank Empty setup in menu screen 8.3 DIGITAL INPUT. A low level switch in the reservoir can activate this alarm.
  - **Empty Tank Drain** – The drain water reservoir is empty. This alarm is generated through the digital input Drain Tank Empty setup in menu screen 8.3 DIGITAL INPUT. A low level switch in the reservoir can activate this alarm.
  - **EC Sensor Difference** – When the difference between the control and verify EC probes reaches the set amount, this alarm will be generated.
  - **pH Sensor Difference** – When the difference between the control and verify pH probes reaches the set amount, this alarm will be generated.

- **Irrigation and Dosing [Value in range STOP or CONTINUE]** – Action applied to processes.
    - **STOP** – Stop irrigation and/or dosing.
    - **CONTINUE** – Continue irrigation and/or dosing. This option means that the system will register an alarm but will not take action.
- **Delay [Value in range 00:00 to 99:59]** – Define the period that the failure must be active before the NMC Pro will register an alarm and take action.
- **Alarm Active [Value in range No or Yes]** – Define whether the alarm output should be triggered by the corresponding alarm.

	An alarm will be generated on the NMC Pro even if the alarm settings are set to continue the process and/or the alarm output has been set to not active.

4.2.3.9 SMS SUBSCRIPTION

FIGURE 84. SMS SUBSCRIPTION ALARMS



SMS SUBSCRIPTION

Alarm/Group	JOE BURGER	JACK SMITH	------	------
*Hardware	PRIORITY	YES	NO	NO
*System	PRIORITY	YES	NO	NO
*Hydraulic	PRIORITY	YES	NO	NO
*Dosing	YES	YES	NO	NO
HIGH FLOW	YES	NO	NO	NO
LOW FLOW	YES	NO	NO	NO
WATER LEAK	YES	NO	NO	NO
LOW PRES PRESSOS	NO	NO	NO	NO
DELTA PRESSURE	YES	NO	NO	NO
SYS LOW PRESSURE	YES	NO	NO	NO
NO FLOW	YES	NO	NO	NO
FLOW ALARM	YES	NO	NO	NO
IRRIG W/O DRAIN	NO	NO	NO	NO
EMPTY TANK FRESH	NO	NO	NO	NO
EMPTY TANK DRAIN	NO	NO	NO	NO
NEGATIVE FLOW	YES	NO	NO	NO
FERT LEAK	YES	NO	NO	NO
FERT FAIL	YES	NO	NO	NO
EC HIGH	YES	NO	NO	NO
EC LOW	YES	NO	NO	NO
PH HIGH	YES	NO	NO	NO
PH LOW	YES	NO	NO	NO
EC PRE HIGH	NO	NO	NO	NO
EC PRE LOW	NO	NO	NO	NO
EMERGENCY_EC	YES	NO	NO	NO
EMERGENCY PH	YES	NO	NO	NO
TEMP SEN SHORT	NO	NO	NO	NO
TEMP SEN CUT OFF	NO	NO	NO	NO
TEMP SEN FAIL	NO	NO	NO	NO
RELAY CARD FAIL	YES	NO	NO	NO
IO CARD FAIL	YES	NO	NO	NO
ANALOG IN FAIL	YES	NO	NO	NO
ANALOG OUT FAIL	YES	NO	NO	NO
DIGIT IN FAIL	YES	NO	NO	NO
PRES IN SEN FAIL	NO	NO	NO	NO
PRESOUT SEN FAIL	NO	NO	NO	NO
PRES SEN FAIL	NO	NO	NO	NO
EC SEN FAIL	YES	NO	NO	NO
PH SEN FAIL	YES	NO	NO	NO
OUT TEMP SEN SHO	YES	NO	NO	NO
OUT TEMP SEN CUT	YES	NO	NO	NO
OUT TEMP SEN FAI	YES	NO	NO	NO
SHORT CIRCUIT	YES	NO	NO	NO
HOST UNIT ERROR	NO	NO	NO	NO
EXPBOX1 COM FAIL	YES	NO	NO	NO
EXPBOX2 COM FAIL	YES	NO	NO	NO
EXPBOX3 COM FAIL	YES	NO	NO	NO
DOS BOOST PRTCN	NO	NO	NO	NO
WEATHER STATION	YES	NO	NO	NO
RADIATION FACTOR	YES	NO	NO	NO
REMOTE OUT KEY	NO	NO	NO	NO
REMOTE UNIT OFF	NO	NO	NO	NO
RTU OUTPUT FAIL	NO	NO	NO	NO
EXTERNAL ALARM	YES	NO	NO	NO

NO
YES
PRIORITY

The SMS Subscription menu allows you to define which subscriber will receive an SMS in the event of an active alarm within the listed alarms or group of alarms:

- **NO** – SMS will not be sent to this subscriber for this alarm.
- **YES** – SMS will be sent to this subscriber in the event of an alarm within the times of day that are set for the send period.
- **PRIORITY** – SMS will be sent to this subscriber in the event of an alarm, immaterial of the send period.

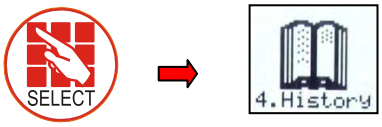
The send period for sending out an SMS is defined in menu 6.12 *SMS SETUP.* Verify that the subscriber is defined as ACTIVE in the menu 6.11 *EDIT SMS PHONEBOOK*. See 3.2 *Installation – Software – NMC Irrigation* of the *CMT Manual*.

	The NMC Junior does not feature SMS Subscription.

4.2.4 HISTORY

In the **MAIN MENU** screen place the cursor on the history icon and press ENTER, or press "**4**" to enter the **4.HISTORY** menu.

FIGURE 85. HISTORY MENU SCREEN



HISTORY	
1.	IRRIGATION LOG
2.*	RAD. SUM & DRAIN LOG
3.	UNCOMPLETED IRRIGATION
4.	UNCOMPLETED PROGRAMS
5.	DAILY IRRIGATION
6.	IRRIGATION ACCUMULATION
7.	WATER & AUX METER ACCU.
8.	ACCUMULATION RESET
9.	FILTERS
10.	COOLING
11.	SENSORS LOG
12.	EVENT LOG
13.	SYSTEM LOG

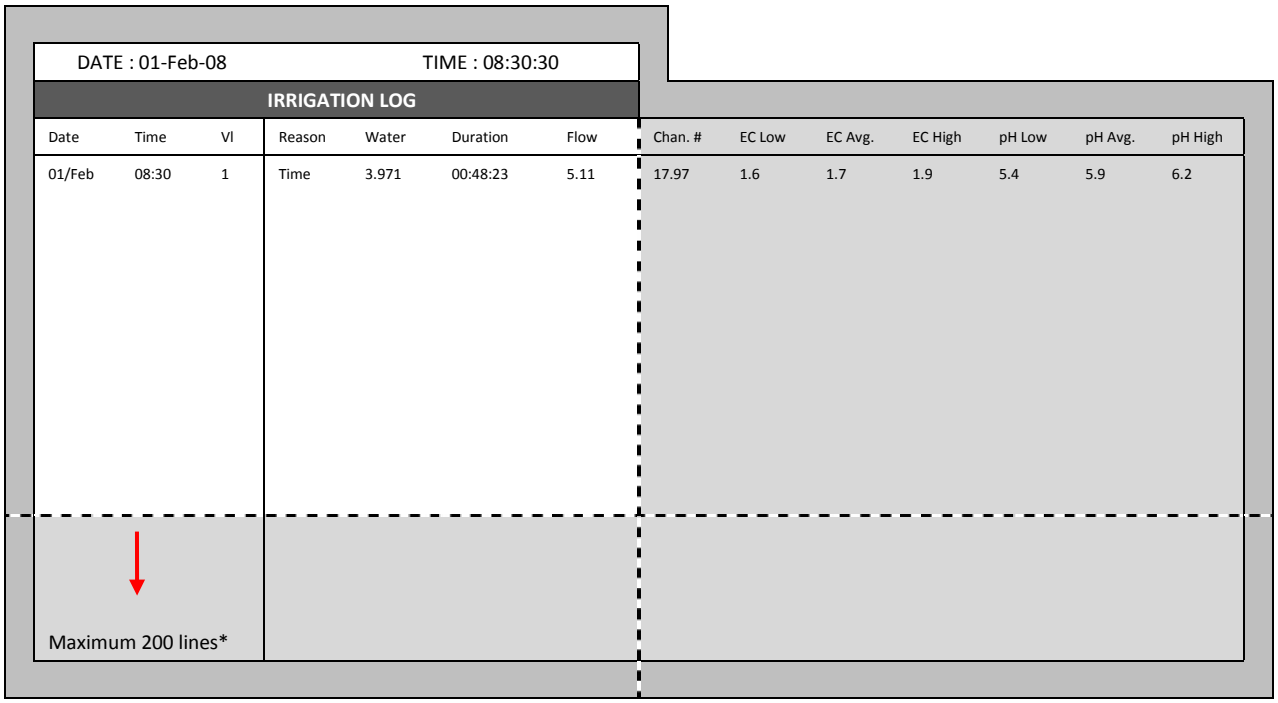
The history menu provides extensive information regarding measurements and processes performed by the NMC Pro.

JR	*This does not apply in the NMC Junior.

4.2.4.1 IRRIGATION LOG

The irrigation log table includes up to 200 rows of recent irrigations data, each row includes information of a valve that was activated for irrigation. To view additional information use the **left/right arrow** keys, to switch between dosing quantities or time simply press the **+/-** key.

FIGURE 86. IRRIGATION LOG SCREEN



JR	* Maximum 100 lines in the NMC Junior.

DATE (dd-MMM-yy) – Current date.
TIME (hh:mm:ss) – Current time.
IRRIGATION LOG

- **Date (dd-MMM)** – Date when the irrigation started.
- **Time (hh:mm)** – Time when the irrigation started.
- **Valve** – Valve number (for a group of valves the number of the leading valve will be displayed).
- **Reason** – Irrigation trigger: Time, Condition, Radiation Sum, Manual, Uncompleted.
- **Water (m^3)** – Irrigation quantity.
- **Duration (hh:mm:ss)** – Irrigation duration.
- **Flow (m^3/h)** – Average flow throughout the irrigation cycle.
- **Dosing Channel Quantity (litres)** – Dosing quantities per channel. The number of dosing channels setup will be displayed, maximum number is 8.
- **EC Low** – Lowest EC value recorded during irrigation.
- **EC Avg.** – Average EC value recorded during irrigation.
- **EC High** – Highest EC value recorded during irrigation.

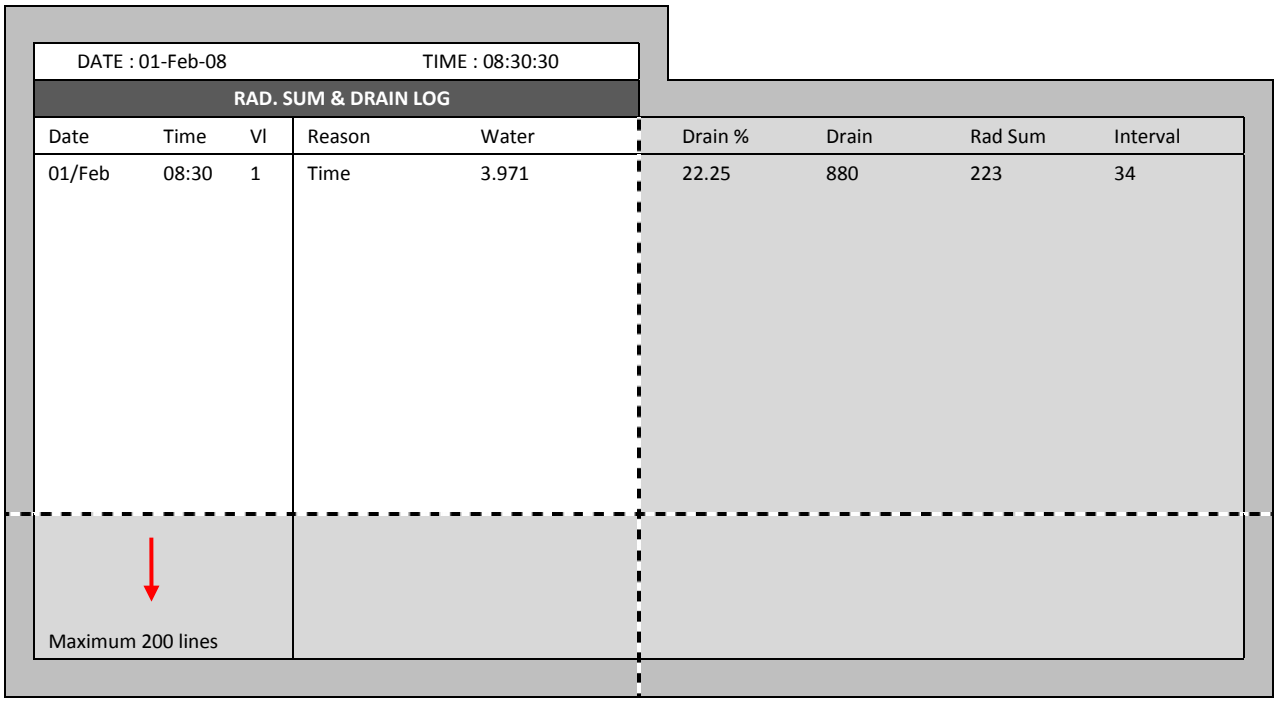
- **pH Low** – Lowest pH value recorded during irrigation.
- **pH Avg.** – Average pH value recorded during irrigation.
- **pH High** – Highest pH value recorded during irrigation.

4.2.4.2 RADIATION SUM AND DRAINAGE LOG

This table provides information on radiation sum levels accumulated and drainage quantities measured.

JR	This feature does not apply to the NMC Junior.

FIGURE 87. RADIATION SUM AND DRAINAGE LOG SCREEN



DATE (dd-MMM-yy) – Current date.
TIME (hh:mm:ss) – Current time.
RAD. SUM & DRAIN LOG

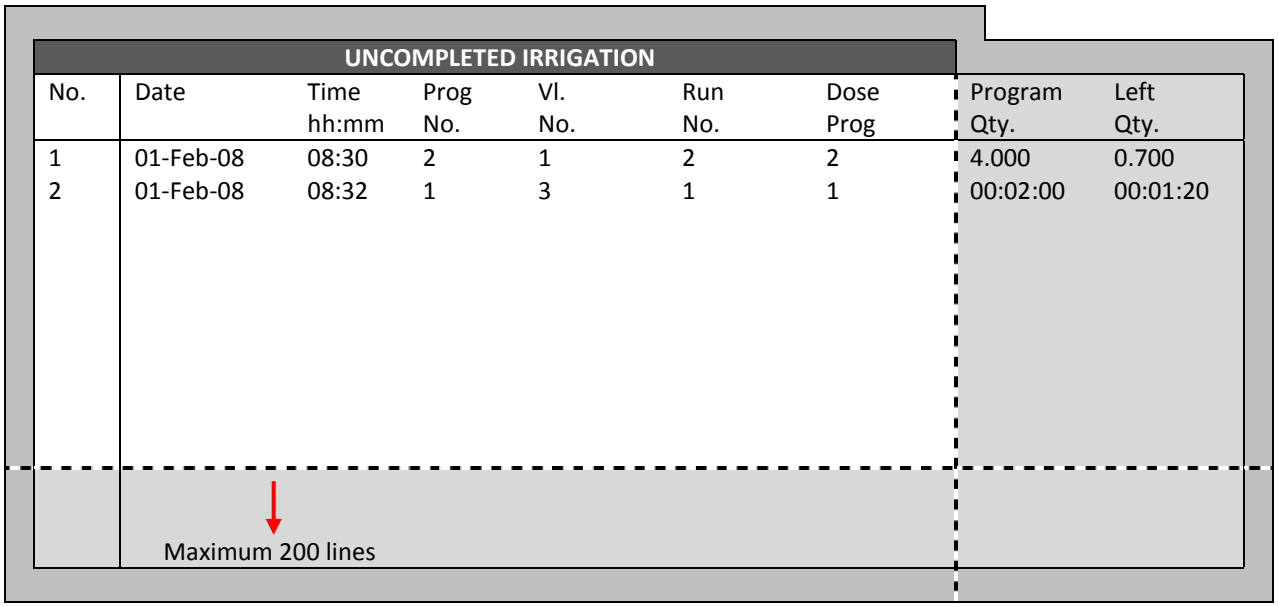
- **Date (dd-MMM)** – Date when the irrigation started.
- **Time (hh:mm)** – Time when the irrigation started.
- **Valve** – Valve number (for a group of valves the number of the leading valve will be displayed).
- **Reason** – Irrigation trigger: Time, Condition, Radiation Sum, Manual, etc.
- **Water (m^3)** – Irrigation quantity.
- **Drainage (%)** – Percentage of drainage for the relevant irrigation cycle.
- **Drainage (litres)** – Drainage quantity for the relevant irrigation cycle.
- **Radiation Sum (J/cm^2)** – Accumulated radiation sum level when the irrigation started.
- **Interval (minutes)** – Time since the last irrigation cycle, referring to the last irrigation of a specific valve.

4.2.4.3 UNCOMPLETED IRRIGATION

The uncompleted irrigation table provides information of irrigation cycles that were started but could not be completed for individual valves. To understand why an irrigation cycle was not completed it is advisable to cross reference between this table and the **3.2 ALARM HISTORY** table. The uncompleted irrigation table consists of up to 200 lines.

JR	This feature is indexed as 4.2 UNCOMPLETED IRRIGATION in the NMC Junior.

FIGURE 88. UNCOMPLETED IRRIGATION SCREEN



UNCOMPLETED IRRIGATION

- **Number** – Uncompleted irrigation line number.
- **Date (dd-MMM-yy)** – Date that the failure occurred and the line was added to the uncompleted irrigation table.
- **Time (hh:mm)** – Time that the failure occurred and the line was added to the uncompleted irrigation table.
- **Program Number** – Irrigation program number.
- **Valve Number** - Indicates the associated valve. If a failure occurs for a group of valves, that were configured to irrigate together, only the first valve number of the group is shown but a '**+**' sign is added next to it to indicate that more valves are associated.
- **Run Number** – Indicates the associated water run time program.
- **Dosing Program Number** – Indicates the associated dosing program.
- **Programmed Quantity (m^3 or hh:mm:ss)** – Set quantity from the water run time program. The water runtime method will determine the unit as m^3 or time.
- **Left Quantity (m^3 or hh:mm:ss)** – Uncompleted quantity. The water runtime method will determine the unit as m^3 or time.

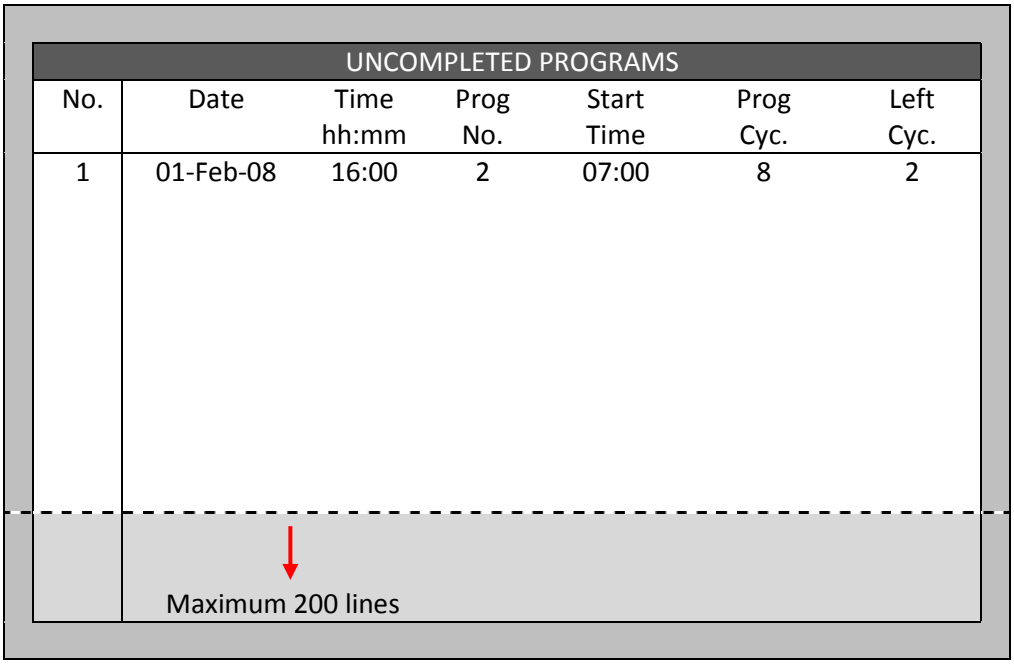
NB	In order to manually stop an uncompleted irrigation you must go to the 2.3 START/STOP VALVE menu screen, because the activation is according to single valves. The NMC Pro will attempt to complete the irrigation cycle for the current day (until end day time) upon manual or automatic alarm reset. Please also note: • The valve number of irrigations that are to be completed will be highlighted. • The valve number of irrigations that are currently being completed will blink.

4.2.4.4 UNCOMPLETED PROGRAMS

It is important to understand the difference between this table and the 4.3 UNCOMPLETED IRRIGATION table. This table provides information on irrigation programs that could not be completed. The uncompleted program table consists of 200 lines.

JR	This feature is indexed as 4.3 UNCOMPLETED PROGRAMS in the NMC Junior.

FIGURE 89. UNCOMPLETED PROGRAMS SCREEN



UNCOMPLETED PROGRAMS

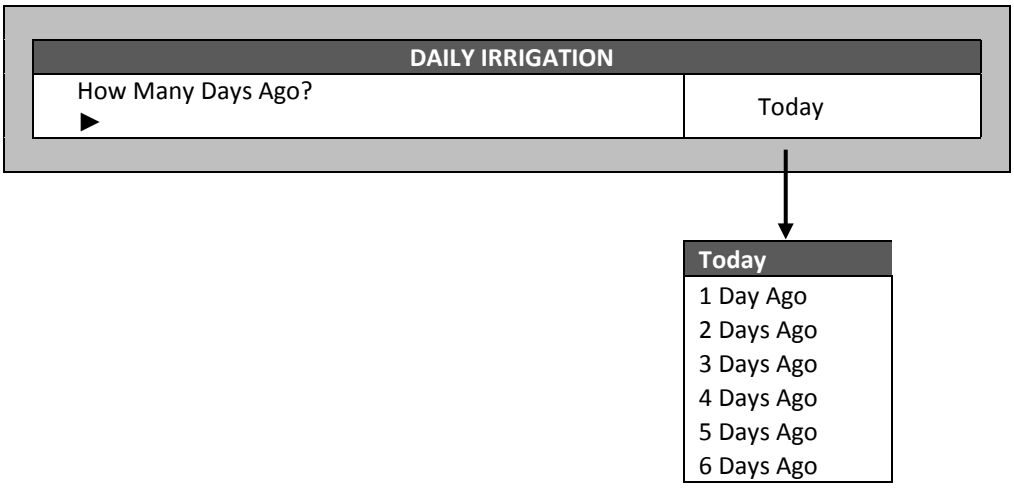
- **Number** – Uncompleted programs line number.
- **Date (dd-MMM-yy)** – Date that the failure occurred and the line was added to the uncompleted programs table.
- **Time (hh:mm)** – Time that the failure occurred and the line was added to the uncompleted programs table.
- **Program number** – Uncompleted irrigation program number.
- **Start time (hh:mm)** – Irrigation program start time.
- **Programmed Cycles** – Number of irrigation cycles that were programmed in irrigation program.
- **Left Cycles** – Number of uncompleted irrigation cycles.

4.2.4.5 DAILY IRRIGATION

This table allows you to view history of irrigation quantities or time per valve.

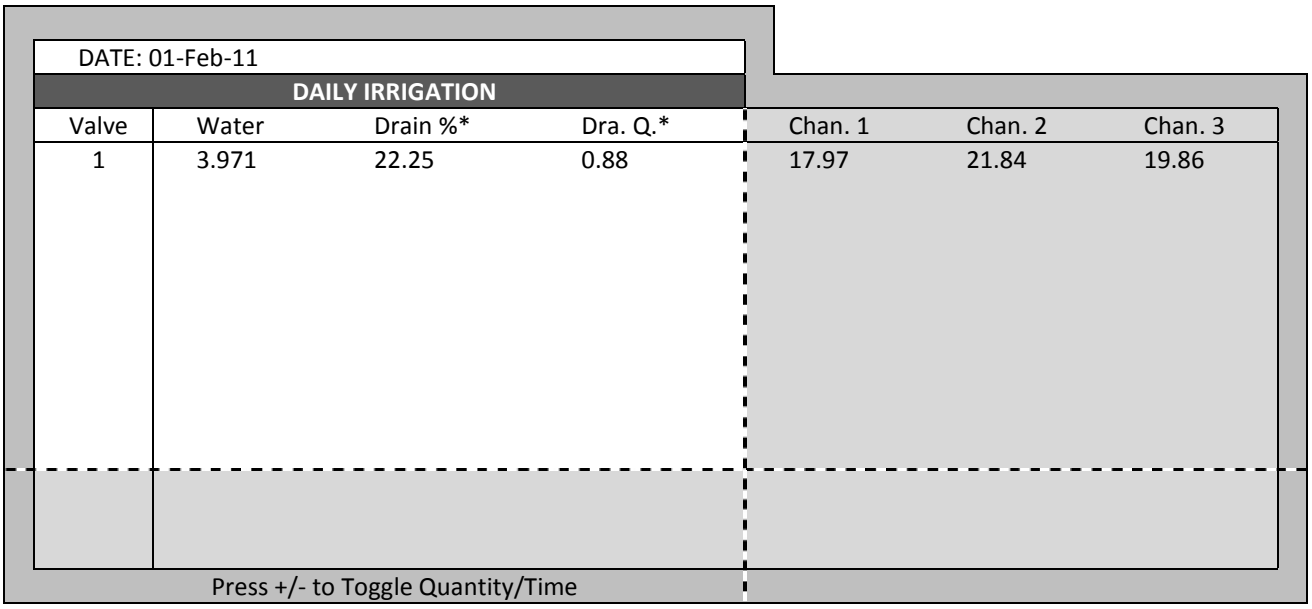
JR	This feature is indexed as 4.4 DAILY IRRIGATION in the NMC Junior.

FIGURE 90. DAILY IRRIGATION HISTORY SELECTION SCREEN



Open pull down menu by pressing **ENTER**, navigate with up/down arrow keys to the option required and press **ENTER** to confirm. Daily irrigation table will be displayed:

FIGURE 91. DAILY IRRIGATION HISTORY SCREEN



- **DATE (dd-MMM-yy)** – Date for data displayed in table.
- **DAILY IRRIGATION**
  - **Valve** – Valve number.
  - **Water (m³)** – Irrigation quantity.
  - ***Drainage (%)** – Percentage of drainage for the relevant irrigation cycle.
  - ***Drainage Quantity (m³)** – Drainage quantity for the relevant irrigation cycle.
  - **Dosing Channel Quantity (liters)** – Dosing quantities per channel. The number of dosing channels setup will be displayed, maximum number is 8.

NB	To change the data viewed between quantity and time press the +/- key.

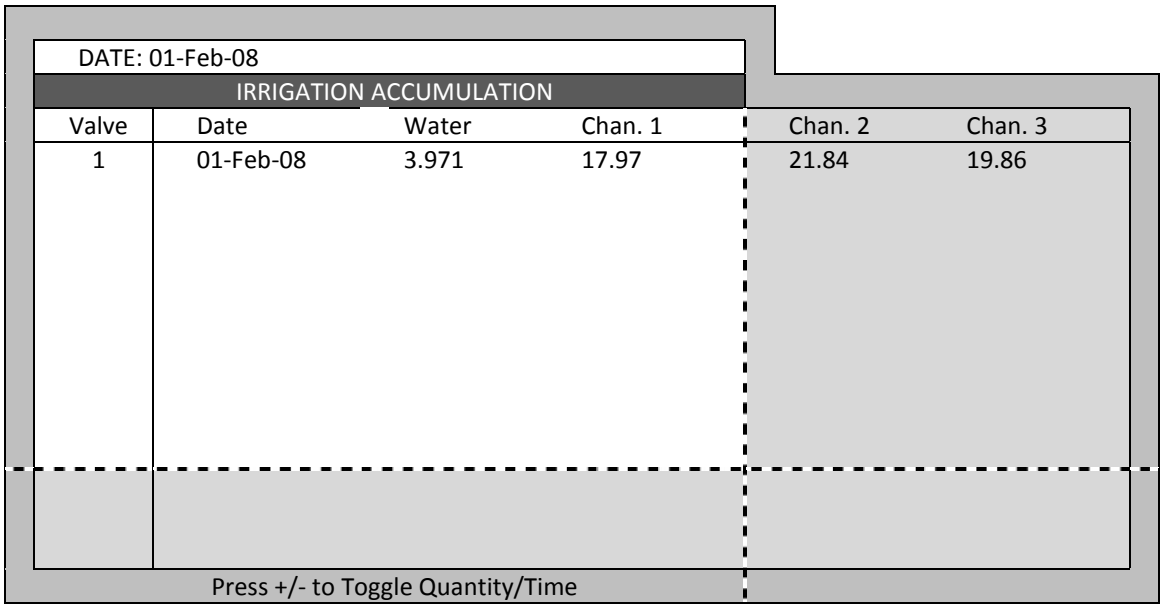
JR	*These features do not apply to the NMC Junior.

4.2.4.6 IRRIGATION ACCUMULATION

The irrigation accumulation table allows you to accumulate water and dosing quantities for specific valves and in required periods. The accumulation of each valve can be reset separately in the **4.8 ACCUMULATION RESET** table.

JR	This feature is indexed as 4.5 IRRIGATION ACCUMULATION in the NMC Junior.

FIGURE 92. IRRIGATION ACCUMULATION SCREEN



DATE (dd-MMM-yy) – Current date.
IRRIGATION ACCUMULATION

- **Valve** – Valve number.
- **Date (dd-MMM-YY**) - Date for data displayed in table.
- **Water (m³)** – Accumulated irrigation quantity per valve.
- **Dosing Channel Quantity (litres)** – Accumulated dosing quantities per channel and per valve. The number of dosing channels setup will be displayed, maximum number is 8.

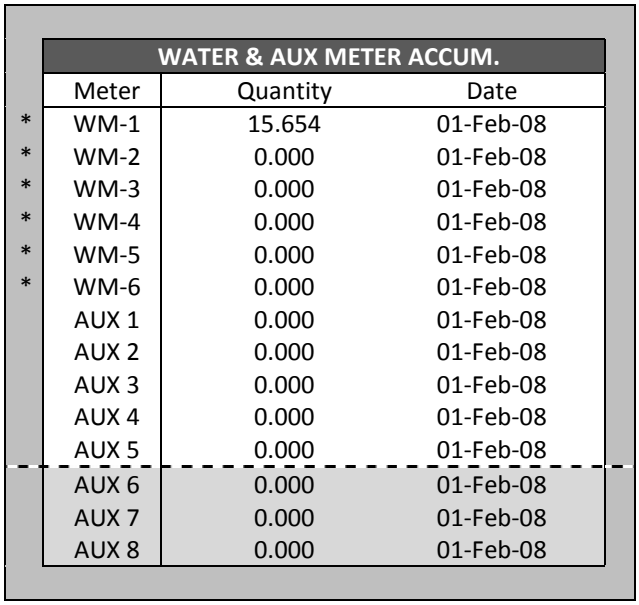
NB	To change the data viewed between quantity and time press the +/- key.

4.2.4.7 WATER AND AUXILIARY METER ACCUMULATION

The WATER METER accumulation allows you to accumulate the total quantity of water passed through the irrigation system water meter from the last time it was reset.

The AUXILIARY METER accumulation allows you to accumulate the total quantity of water from meters that do not have any other connection in the software. These water meters are accumulators only and are not a part of the irrigation control. For example: Measure filter back flush water quantity, measure the cooling system consumption, etc.

FIGURE 93. WATER AND AUXILIARY METER ACCUMULATION SCREEN



	WATER & AUX METER ACCUM.		
	Meter	Quantity	Date
*	WM-1	15.654	01-Feb-08
*	WM-2	0.000	01-Feb-08
*	WM-3	0.000	01-Feb-08
*	WM-4	0.000	01-Feb-08
*	WM-5	0.000	01-Feb-08
*	WM-6	0.000	01-Feb-08
	AUX 1	0.000	01-Feb-08
	AUX 2	0.000	01-Feb-08
	AUX 3	0.000	01-Feb-08
	AUX 4	0.000	01-Feb-08
	AUX 5	0.000	01-Feb-08
	AUX 6	0.000	01-Feb-08
	AUX 7	0.000	01-Feb-08
	AUX 8	0.000	01-Feb-08

WATER & AUX METER ACCUM.

- **Meter** – Relevant water or auxiliary meter
- **Quantity (m³)** – Accumulated quantity for relevant meter.
- **Date (dd-MMM-yy)** – Date of last accumulator reset for the relevant meter.

NB	Quantities displayed up to 9 999 999 m³.

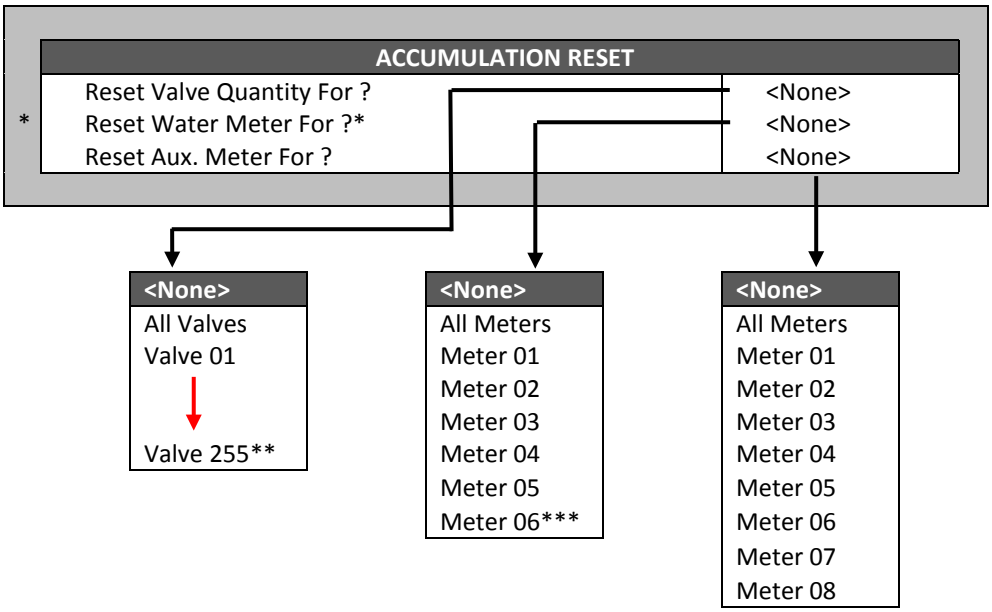
JR	This feature is indexed as 4.6 AUXILIARY METER ACCUMULATION in the NMC Junior. It excludes water meters accumulation.*

4.2.4.8 ACCUMULATION RESET

Various options are available for resetting accumulators, choose to reset for valve/s, water meter/s and auxiliary meter/s.

JR	This feature is indexed as 4.7 ACCUMULATION RESET in the NMC Junior.

FIGURE 94. ACCUMULATION RESET SCREEN



ACCUMULATION RESET

- Reset Valve Quantity For? [Value in range None, All Valves or Valve 1 to 255] – Reset:
  - None – Nothing will be reset.
  - All Valves – All valves setup will be reset.
  - Valve 1 to 255 – Only selected valve will be reset.

- Reset Water Meter For? [Value in range None, All Meters or Meter 1 to 6] – Reset:
  - None – Nothing will be reset.
  - All Meters – All meters setup will be reset.
  - Meter 1 to 6 – Only selected meter will be reset.

- Reset Auxiliary Meter For? [Value in range None, All Meters or Meter 1 to 8] – Reset:
  - None – Nothing will be reset.
  - All Meters – All meters setup will be reset.
  - Meter 1 to 8 – Only selected meter will be reset.

NB	When resetting a valve/s, its history will be deleted from the 4.5 DAILY IRRIGATION and 4.6 IRRIGATION ACCUMULATION tables. When resetting an auxiliary meter, its history will be deleted from the 4.7 WATER AND AUXILIARY METER ACCUMULATION table.

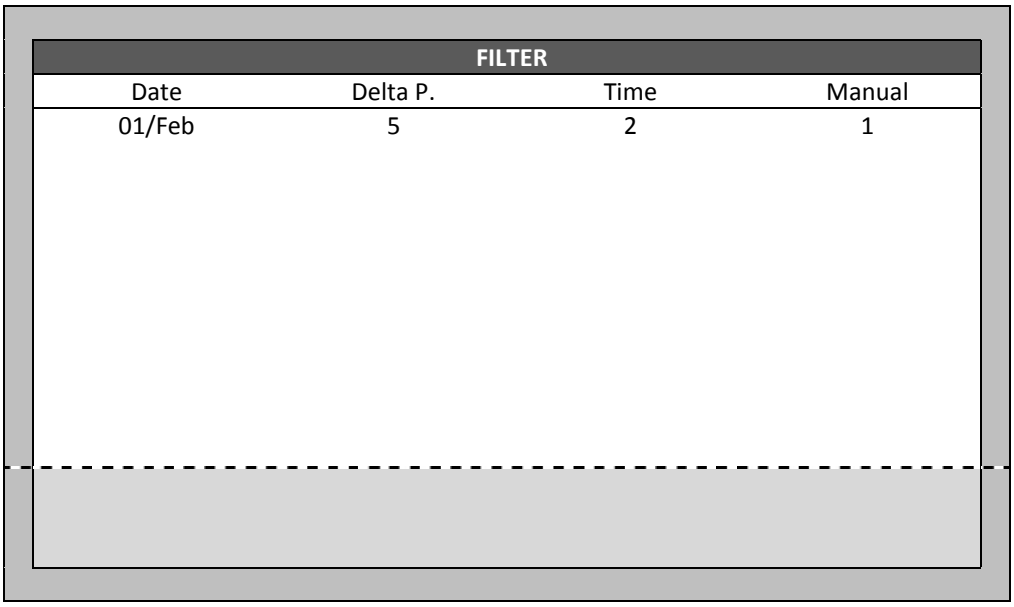
	In the NMC Junior. - 'Reset Water Meter For' does not apply * - The valve number goes up to 15 ** - The meter number goes up to 06 ***

4.2.4.9 FILTERS

The filter history table provides information, summarised per day, of the number of filter back flush events activated by: Delta pressure, time and manually.

JR	This feature is indexed as 4.8 FILTERS in the NMC Junior.

FIGURE 95. FILTRATION HISTORY SCREEN



FILTER

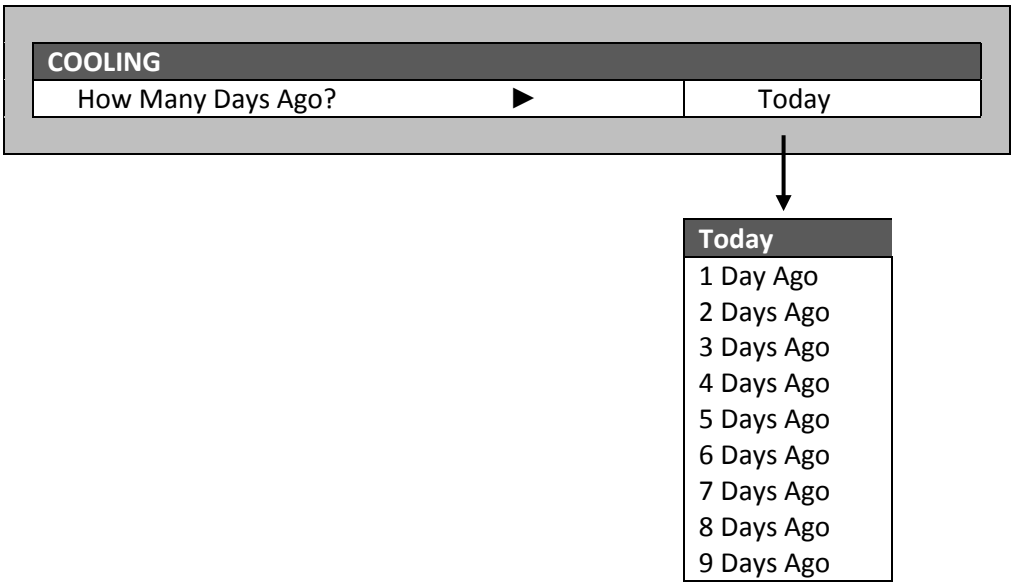
- **Date (dd/MMM)** – Date the information was recorded in the table.
- **Delta Pressure** – Number of filter flush cycles triggered by pressure difference across filters.
- **Time** – Number of filter flush cycles triggered by time.
- **Manual** – Number of manually started filter flush cycles.

4.2.4.10 COOLING

View the history of cooling / humidification activities per program:

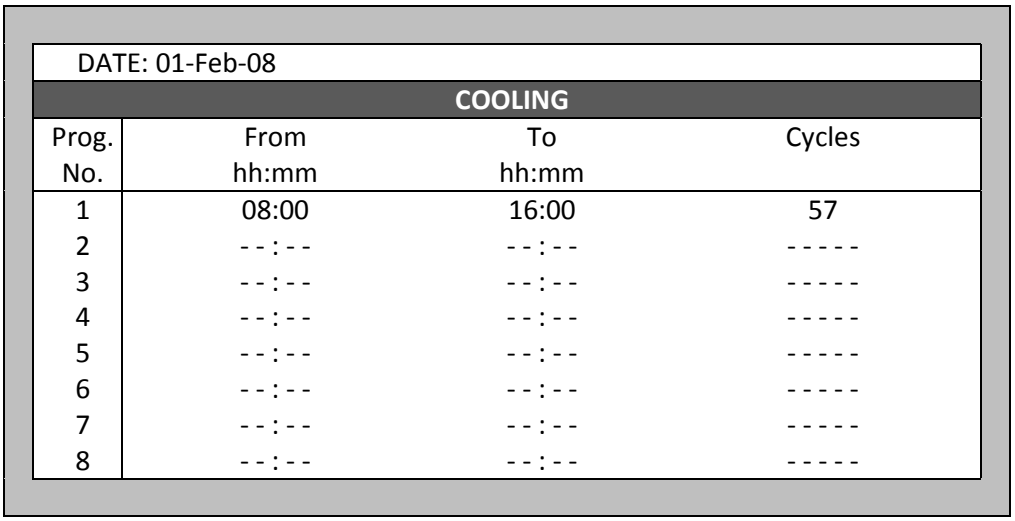
JR	This feature is indexed as 4.9 COOLING in the NMC Junior.

FIGURE 96. COOLING HISTORY SELECTION SCREEN



Open pull down menu by pressing **ENTER**, navigate with up/down arrow keys to the option required and press **ENTER** to confirm. Daily cooling table will be displayed:

FIGURE 97. COOLING HISTORY SCREEN



DATE: 01-Feb-08

COOLING

Prog. No.	From hh:mm	To hh:mm	Cycles
1	08:00	16:00	57
2	--:--	--:--	-----
3	--:--	--:--	-----
4	--:--	--:--	-----
5	--:--	--:--	-----
6	--:--	--:--	-----
7	--:--	--:--	-----
8	--:--	--:--	-----

DATE (dd-MMM-yy) – Date for data displayed in table.

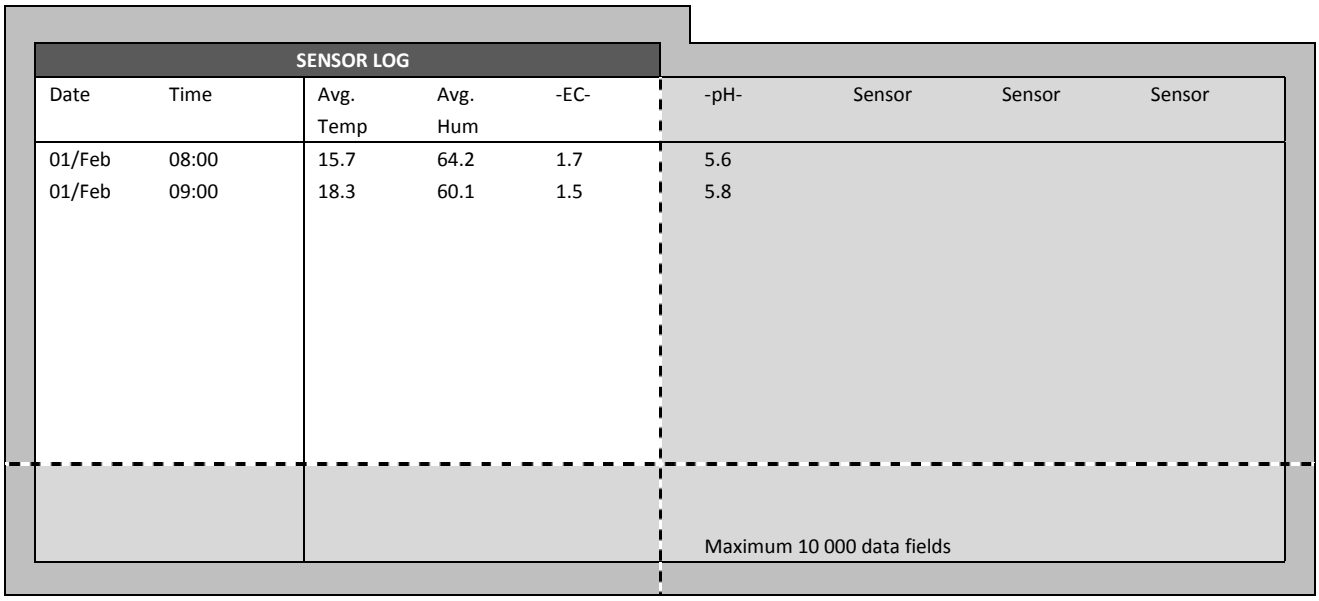
COOLING

- **Program Number** – Cooling program number.
- **From (hh:mm)** – Start of cooling / humidification program.
- **To (hh:mm)** – End of cooling / humidification program.
- **Cycles** – Number of cycles completed.

4.2.4.11 SENSOR LOG

The sensor log table include history of average measurements of logged sensors. The type of sensor that will be logged here is setup in 6.8 SENSOR LOGGING and the frequency of data logged on line History Resolution under the heading HISTORY in 6.2 SYSTEM SETUP.

FIGURE 98.SENSOR LOG SCREEN



SENSOR LOG

- **Date (dd/MMM)** – Date data was logged.
- **Time (hh:mm)** – Time data was logged.
- **Average Temperature (°C)** – Average temperature recorded during history resolution time.
- **Average Humidity (%)** – Average humidity recorded during history resolution time.
- **EC** - Average EC level recorded during history resolution time.
- **pH** - Average pH level recorded during history resolution time.
- **Sensor** – Additional sensor setup for logging, please see **6.8 SENSOR LOGGING** for all the sensors available for data logging.

The sensor log table contains up to 10 000 data fields. Date and time are 2 fields per line and every sensor is an additional field.

For example: Logging of 2 sensors uses 4 data fields (2 for date and time and 1 for each sensor), in this case the table will consist of a maximum of 2 500 lines.

JR	This feature is indexed as 4.10 SENSOR LOG in the NMC Junior and is limited to 2 x temperature sensors, a humidity sensor, an EC sensor and a pH sensor.

4.2.4.12 EVENT LOG

This table provides information of all the processes performed by the NMC Pro including their date and time.

JR	This feature is indexed as 4.11 EVENT LOG in the NMC Junior.

FIGURE 99. EVENT LOG SCREEN

EVENT LOG			
No.	Event	Date	Time
1	Valve # 1 No Flow	01/Feb	08:30
2	Manual Reset Alarm	01/Feb	08:35
3	Program # 1 Auto Off	01/Feb	08:40
	Maximum 999 last events		

EVENT LOG

- **Number** – Number of event logged.
- **Event** – Description of event logged.
- **Date (dd/MMM)** – Date event was logged.
- **Time (hh:mm)** – Time event was logged**.**

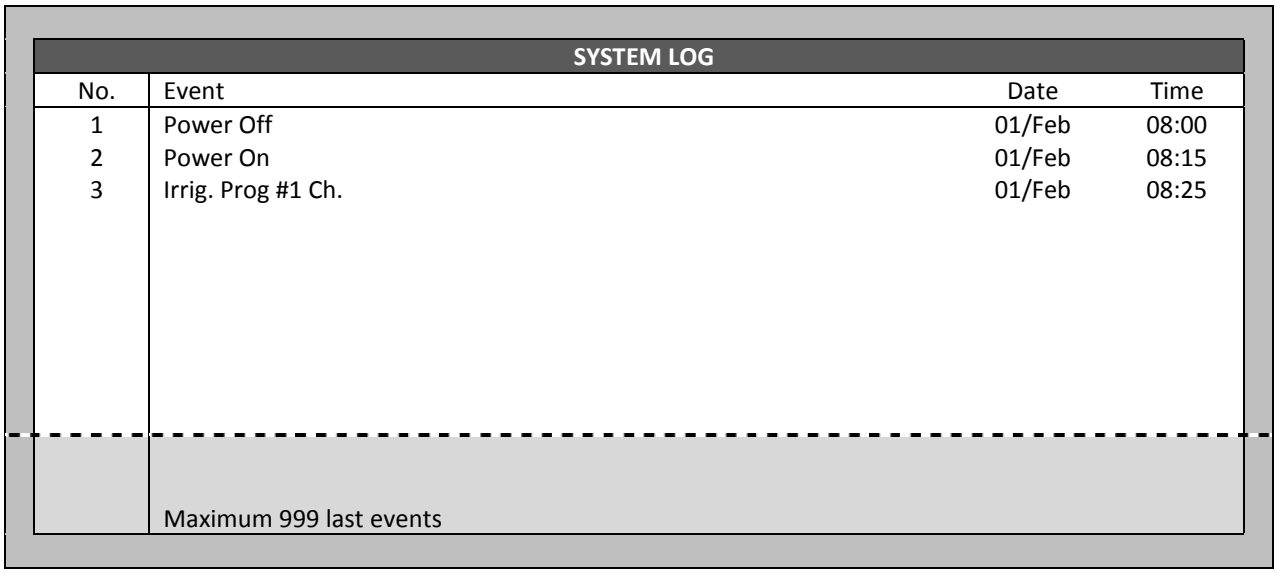
The table will include the 999 most recent events.

4.2.4.13 SYSTEM LOG

This table provides information of all the NMC Pro system changes performed including their date and time.

JR	This feature is indexed as 4.12 SYSTEM LOG in the NMC Junior.

FIGURE 100. SYSTEM LOG SCREEN



SYSTEM LOG

- **Number** – Number of event logged.
- **Event** – Description of event logged.
- **Date (dd/MMM)** – Date event was logged.
- **Time (hh:mm)** – Time event was logged**.**

The table will include the 999 most recent events.