Description	Ope.	ECO	Date	Rev.
Update declaration of conformity	MarCan	0098381	27-Feb-2013	C
Sw upgrade: new supply/return sensor mng, new Simpler MMI mng, various functional changes on customer request.	MarPas	0089869	120607	B
First release – from S4966V2029 rev B	MarPas	0060030	100107	A

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1 - Revisions

Software	Date	Description of amendments
50049955-011	27/11/09	Sw release: C0.11_P0.05_E0.11 (CRC = 0x5931h)
50049955-012	19/12/2011	Sw release: C0.12_P0.06_E0.12 (CRC = 0x518b)

2 - Reference Standards and Approvals

2.1 – Standards

maXsys boiler controller meets the requirements laid down in Standards-documents:

- **EN298:2003**
  Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
- **EN 55014-1**
  Electromagnetic compatibility – Emissions
- **EN 60730 - 1**
  Automatic electric controls for household and similar use
- Regarding electric safety, the S4966 can be used in appliances according to European Standards for household electrical requirements EN 60335 series

2.2 – Approvals

Declaration of Conformity

The boiler control conforms to the following EC - Directives:

- Gas Appliance Directive 2009/142/EC;
- Low Voltage Directive 2006/95/EC;
- Electro Magnetic Compatibility Directive* 2004/108/EC.

* Conformity with Electro Magnetic Compatibility Directive regarding emission for non industrial appliances can be assumed for all selected Ordering Specification (O.S.) numbers.
However conformity can only be declared as part of the appliance.
Regarding immunity, all controls comply with the levels for non industrial appliances.

3 – Quality assurance statement

Products are manufactured under an ISO 9001 (1994) based and certified Quality System.

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The quality system is described in the Honeywell Combustion Controls Center Quality Assurance Program and its related operational procedures and instructions.

The quality system is approved by Gastec against certificate number 9.302/2.

The quality organization is responsible for defining, maintaining, improving and verification of the quality systems in the field of design, production process and field quality service.

Assembly processes are guided by work instructions.

Patrol inspections form part of the assembly processes.

Assembly inspection is performed by employees of the quality control department, using their own authorized equipment.
All inspections (incoming and assembly) are performed by trained personnel and according inspection procedures.

4 - Identification

To ensure product tracking and identification, each board shows:

- Bar code label with production data
- CE pin number: 0063BT1326 printed on the label
- Label showing firmware version, type and model burner control, programming batch, production date

Honeywell part number	Customer part number	Notes
S4966V2052B		

5- Product description

5.1 - General

Family Controller S4966V2052B is intended to be used for premix applications. It is made for fan assisted, direct burner ignition applications.

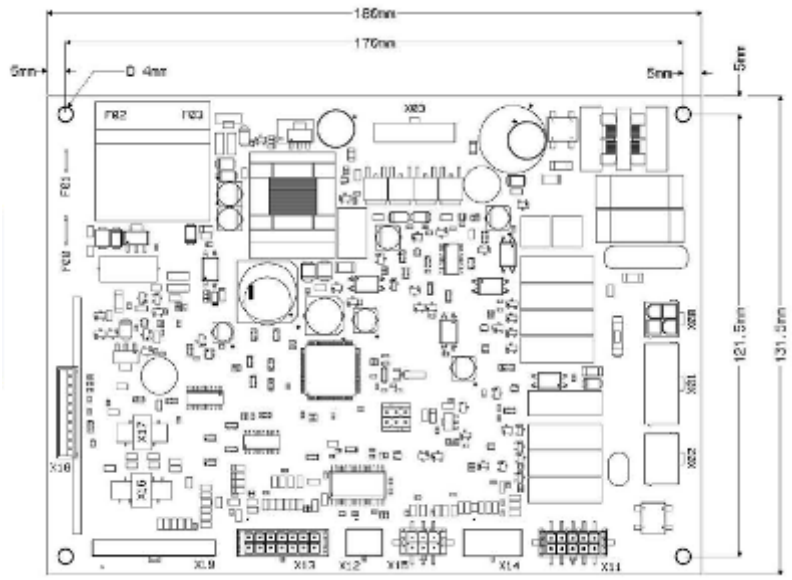
Controller S4966V2052B is configured to exploit functionalities described below:

- operate on 230 Volts, 50/60Hz.
- operate in conjunction with following gas valve of Honeywell families: VK and VR
- Interface an AC-fan with PWM/Tacho control signals (4 wires). Fan is powered via permanent supply line after fuse.
- 3-way diverting valve are driven by on board relay. Optionally a two pump configuration can be supported. 3-way Stepper valve from Honeywell Family VJ can be interfaced by dedicated on board circuitry.
- External ignition devices are supported. Sensing flame rod is provided on board.
- An additional Modulating PWM Pump is featured to drive external devices.
- High Limit protection is based on CH Supply-Return sensors check and on a low voltage switch input.
- Solar Pump functionality is supported: high voltage output and temperature sensor input are featured.
- A dedicated connection to the Simple User Interface is generated. The SUI drives a custom LCD with 27 segments and 2 trimmers. The software handling the logic is on maXsys.
- A dedicated connection slot is foreseen to clip-in communication boards to extend communication via external protocol.
- A connection is possible to interface external Auxiliary Boards implementing specific features or communication protocols.
- Via Microcom connection it is possible to connect the Man Machine Interface from family DSP Honeywell (e.g. DSP49G2060 for Cascade applications).
- OpenTherm Connection is available to connect Room Units. Same input is available to connect also on/off room thermostat.
- High Voltage room thermostat is foreseen.
- Inputs for APS switch, DHW flow sensor/switch, WP sensor/switch, Gas pressure switch are featured.

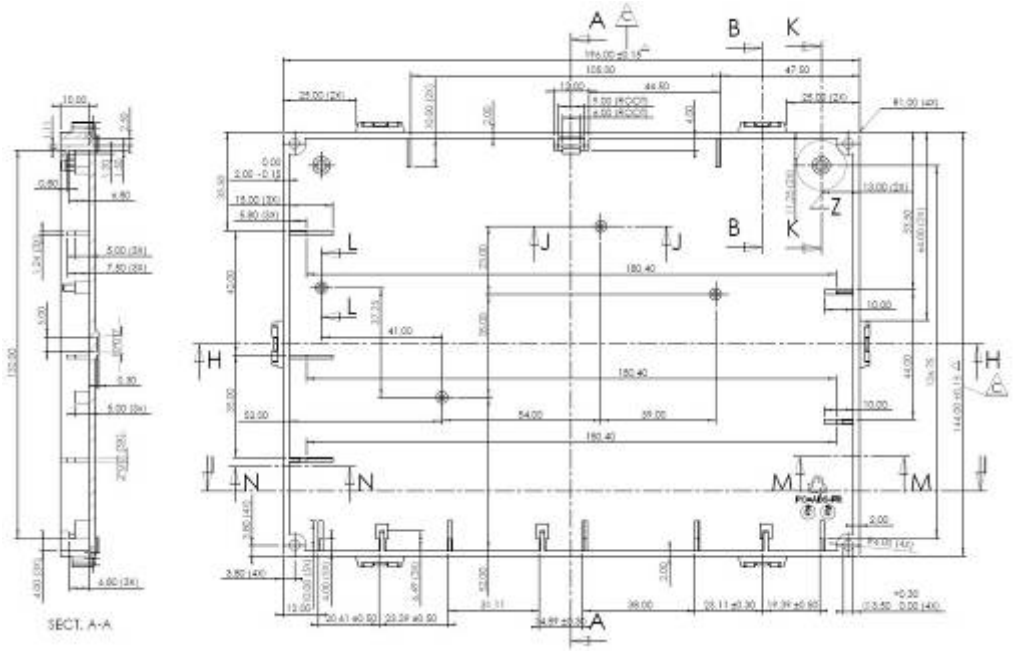
The controller can operate in normal heating mode or in Test Mode. Test Mode is initiated by External Communication.

5.2 – Lay out

Component side view



Plastic Housing bottom



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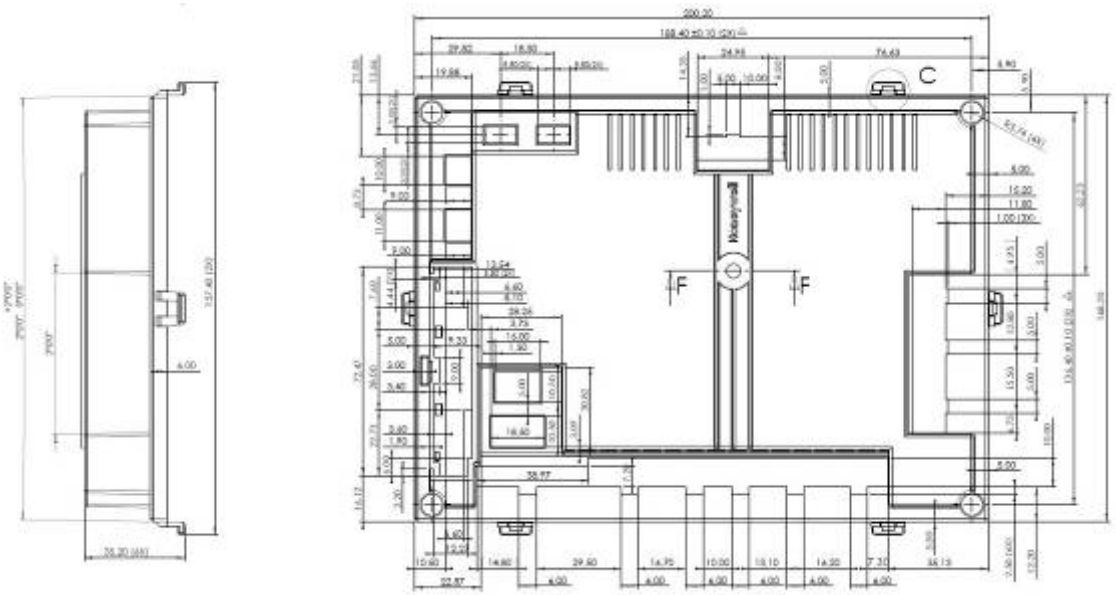
Plastic Housing top



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5.3 – Technical features

5.3.1 – Connector and connections

Connector name	Pin	Type of Connection	Description
HIGH VOLTAGE CONNECTIONS			
X00	1	Molex Minifit (family 5566)	Main Power Line Neutral
X00	2	Molex Minifit	Main Power Line Phase
X00	3	Molex Minifit	Heat Demand – Neutral
X00	4	Molex Minifit	Heat Demand - Line supply
X01	1	Molex Minifit (family 5566)	Solar Pump – Line supply
X01	2	Molex Minifit	CH Pump – Line supply
X01	3	Molex Minifit	3 way DHW – Line supply
X01	4	Molex Minifit	3 way CH or PUMP2 – Line supply
X01	5	Molex Minifit	Fan VAC – Line supply
X01	6	Molex Minifit	Solar Pump – Neutral
X01	7	Molex Minifit	CH Pump – Neutral
X01	8	Molex Minifit	3 way DHW , 3 way CH or PUMP2 – Neutral
X01	9	Molex Minifit	Neutral
X01	10	Molex Minifit	Fan VAC – Neutral
X02	1	Molex Minifit (family 5566)	External Sparking Transformer – Line supply
X02	2	Molex Minifit	External Sparking Transformer – Neutral
X02	3	Molex Minifit	Gas Valve VDC Rectified - Line Supply
X02	4	Molex Minifit	Gas Valve VDC Rectified – Neutral
X02	5	Molex Minifit	Gas Valve VAC - Line Supply
X02	6	Molex Minifit	Gas Valve VAC – Neutral
SAFETY EXTRA LOW VOLATAGE (SELV) CONNECTIONS			
X11	1	Molex Microfit (family 43045)	AC Fan Interface – PWM output
X11	2	Molex Microfit	AC Fan Interface – TACHO input
X11	3	Molex Microfit	Air Pressure Switch - input
X11	4	Molex Microfit	Modulating Pump – PWM output
X11	5	Molex Microfit	Modulating Pump – Supply +24 Vdc
X11	6	Molex Microfit	AC Fan Interface – Supply +24 Vdc
X11	7	Molex Microfit	AC Fan Interface – ground
X11	8	Molex Microfit	Air Pressure Switch – ground

Connector name	Pin	Type of Connection	Description
X11	9	Molex Microfit	Modulating Pump – ground
X11	10	Molex Microfit	Modulating Pump – V6 Vdc
X12	1	Molex Microfit (family 43045)	3-way Stepper driver – COIL1 +
X12	2	Molex Microfit	3-way Stepper driver – COIL1 -
X12	3	Molex Microfit	3-way Stepper driver – COIL2 +
X12	4	Molex Microfit	3-way Stepper driver – COIL2 -
X13	1	Molex Microfit (family 43045)	Water Pressure sensor– Supply +5V
X13	2	Molex Microfit	Water Pressure sensor/switch – ground
X13	3	Molex Microfit	Flow sensor/switch or Siphon sensor – input
X13	4	Molex Microfit	DHW NTC sensor – input
X13	5	Molex Microfit	CH RETURN NTC sensor – input
X13	6	Molex Microfit	CH1 SUPPLY NTC sensor – input
X13	7	Molex Microfit	High Limit Switch or CH2 SUPPLY sensor - input
X13	8	Molex Microfit	Water Pressure sensor/switch – input
X13	9	Molex Microfit	Flow sensor or Siphon sensor – Supply V6
X13	10	Molex Microfit	Flow sensor/switch or Siphon sensor – ground
X13	11	Molex Microfit	DHW NTC sensor – ground
X13	12	Molex Microfit	CH RETURN NTC sensor – ground
X13	13	Molex Microfit	CH1 SUPPLY NTC sensor – ground
X13	14	Molex Microfit	High Limit Switch – Supply
X14	1	Molex Microfit (family 43045)	TTB Flue sensor – input
X14	2	Molex Microfit	Outside temperature Sensor (OTC) – input
X14	3	Molex Microfit	OPENTHERM RoomUnit – signal
X14	4	Molex Microfit	Solar Temperature Sensor – input
X14	5	Molex Microfit	TTB Flue sensor – ground
X14	6	Molex Microfit	Outside temperature Sensor (OTC) – ground
X14	7	Molex Microfit	OPENTHERM RoomUnit – ground
X14	8	Molex Microfit	Solar Temperature Sensor – ground
X15	1	Molex Microfit (family 43045)	Microcom connection – +24 Vdc
X15	2	Molex Microfit	Microcom connection – Rx
X15	3	Molex Microfit	Microcom connection – V6
X15	4	Molex Microfit	Microcom connection – ground
X15	5	Molex Microfit	Microcom connection – Tx
X15	6	Molex Microfit	Microcom connection – input
X16	1	Flat cable	Simple User Interface – CLOCK

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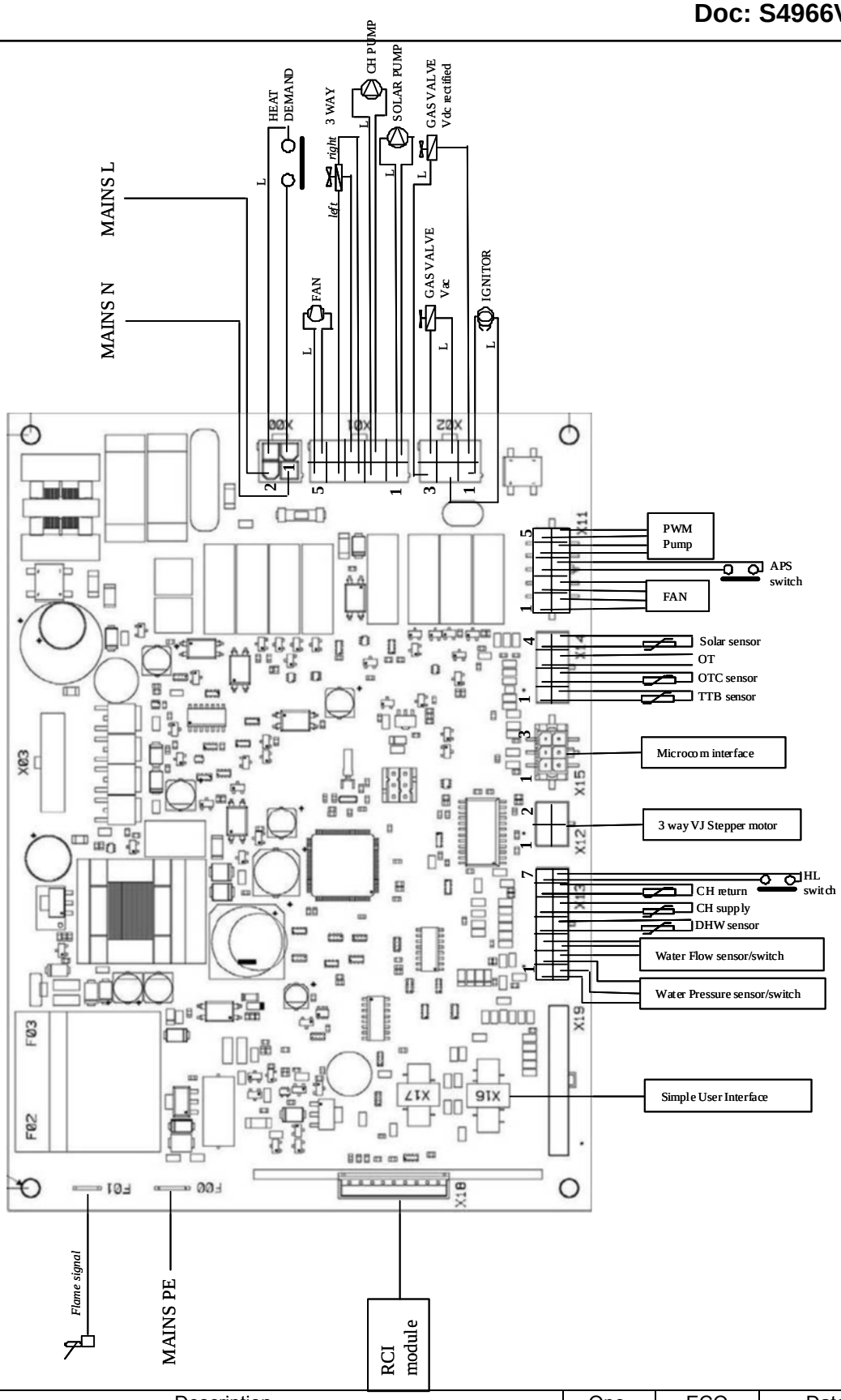
Connector name	Pin	Type of Connection	Description
X16	2	Flat cable	Simple User Interface – LATCH
X16	3	Flat cable	Simple User Interface – DATA
X16	4	Flat cable	Simple User Interface – TRIMMER 1
X16	5	Flat cable	Simple User Interface – TRIMMER 2
X16	6	Flat cable	Simple User Interface – +5 Vdc
X16	7	Flat cable	Simple User Interface – BACKLIGHT
X16	8	Flat cable	Simple User Interface – V6
X16	9	Flat cable	Simple User Interface – +24 Vdc
X16	10	Flat cable	Simple User Interface – ground
X17	1	Flat cable	Auxiliary Board connection – +24Vdc
X17	2	Flat cable	Auxiliary Board connection – V6
X17	3	Flat cable	Auxiliary Board connection – +5Vdc
X17	4	Flat cable	Auxiliary Board connection – SPI SS1
X17	5	Flat cable	Auxiliary Board connection – SPI SCK
X17	6	Flat cable	Auxiliary Board connection – SPI MOSI
X17	7	Flat cable	Auxiliary Board connection – SPI MISO
X17	8	Flat cable	Auxiliary Board connection – ground
X18	1	Plug in connector	Clip in connection – SPI MOSI
X18	2	Plug in	Clip in connection – SPI MISO
X18	3	Plug in	Clip in connection – SPI SCK
X18	4	Plug in	Clip in connection – SPI SS2
X18	5	Plug in	Clip in connection – V6
X18	6	Plug in	Clip in connection – round
X18	7	Plug in	Clip in connection – Rx
X18	8	Plug in	Clip in connection – Reset
FLAME INPUT CONNECTION			
F01		4.8 x 0.8 mm Faston Tab	Flame rod input
EARTH CONNECTION			
F00		6.3 x 0.8 mm faston Tab	Earth Connection



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5.3.2 – Specifications (nominal data)

Supply voltage

- 230 Vac -15% + 10%
- 47 – 65 Hz
- Two fuses on board (L and N): 3.15 A

Board Power consumption

- < 3 W in Stand-by mode
- 18 VA max power consumption

Humidity

- 90% RH max at 40°C (no condensing)

Ambient temperature

- Operating Temperature: -10° – 60 °C
- Storage Temperature: -25° – 80 °C

High Voltage Electrical rating

- High Voltage output below are on fused lines 3.15 A.
- Main inputs: see supply voltage
- CH Pump: 230 Vac, 0,8 A max, cosφ ≥0,6
- 3-way DHW: 230 Vac, 0,8 A max, cosφ ≥0,6
- 3-way CH or PUMP2: 230 Vac, 0,8 A max, cosφ ≥0,6
- Fan VAC: 230Vac Permanent Line Supply
- Gas Valve VRAC Rectified valve: 230 Vrac, 0.4A;
- Gas Valve VAC valve: 230 Vac, 0.4A;
- Solar Pump: 230 Vac, 0,8 A max, cosφ ≥0,6
- Room Thermostat input: heat demand collected if Voltage > 135 Vrms between input and Neutral
- External Sparking Transformer: 230 Vac, 0,8 A max, cosφ=0,6
- Max total current < 3.15 A

Low Voltage Electrical rating

- DC Fan Interface – PWM output: 28 Vdc, 2 mA max, open collector (22kΩ out resistor, 20-28V)
- DC Fan Interface – TACHO input: 28 Vdc, 2 mA max, open collector input (22kΩ pull up resistor, 24V)
- DC Fan Interface – supply: + 24 Vdc, 10 mA max

- Modulating Pump – PWM output: open collector (22kΩ, 6.5 – 8 V)
- Modulating Pump – Supply: + 28 Vdc, 10 mA
- Air Pressure Switch input: Max contact peak current 1.8A (4usec), continuous current 1mA
- Water Pressure Sensor/Switch – Supply: +5Vdc + 22Ohm,
- Water Pressure Sensor/Switch – input : pull up resistance 22kΩ, 20-28V
- Flow sensor/switch – Supply V6: +6.5 – 8 Vdc, 10 mA
- Flow sensor/switch –input : pull up resistance 22kΩ, 20-28V
- 3-way Stepper driver: Bipolar Motor driver – max 280 mA peak-peak, 52Ω
- NTC Sensor inputs: linearization is done by 2K pull up resistor to 5V supply (or 33K for OTC); 2.5mA max current with NCT in short –
- NTS Sensor CH supply, CH return, DHW: Software linearization curve for NTC 12kOhm at 25°C.
- NTC sensors = 12K at 25°C. Beta = 3760 K

Flame sensing

- Flame sensing rode is on separate Tap F01
- Factory parameter setting: minimum flame current 0.8 µA

Timings

- Prepurge time >= 5 s (this time does not include the time needed to check the current air flow)
- Preignition time: 2 s
- Safety time: 3 s
- Number of retrials: 3
- Flame failure response time: <1 s
- Post purge time >= 10 sec
- Stabilization Time: 4 s (default value of parameter)

Prepurge and Postpurge values are minimum values, can be longer based on customer parameters settings.

Communication

- Bit rate: 2400 or 19200 baud
- Byte format: 1 start, 8 data, 1 stop, no parity
- Bit value “1”: low line level at connector
- Bit value “0”: high line level at connector

Length of connecting cables

Conn.	Pin#	Description	Length
X00	1	Main AC neutral	> 10m
X00	2	Main AC line	
X00	3	HV heat demand input (signal)	> 10m
X00	4	HV heat demand input (line)	
X01	1	Solar pump load (line)	> 10m
X01	6	Solar pump load (neutral)	
X01	2	CH pump load (line)	< 1m
X01	7	CH pump load (neutral)	
X01	3	3-way DHW load (line)	< 1m
X01	8	3-way DHW load (neutral)	
X01	4	3-way CH load (line)	< 1m
X01	9	3-way CH load (neutral)	
X01	5	AC fan load (line)	< 1m
X01	10	AC fan load (neutral)	
X02	1	External sparker load (line)	< 1m
X02	2	External sparker load (neutral)	
X02	3	DC gas valve load (pos.)	< 1m
X02	4	DC gas valve load (neg.)	
X02	5	AC gas valve load (line)	< 1m
X02	6	AC gas valve load (neutral)	
X11	1	AC fan interface (PWM)	< 1m
X11	2	AC fan interface (tacho)	
X11	6	AC fan interface (+24V)	
X11	7	AC fan interface (GND)	
X11	3	APS input (signal)	< 1m
X11	8	APS input (GND)	
X11	4	Modulating pump interface (PWM)	< 1m
X11	5	Modulating pump interface (+24V)	
X11	9	Modulating pump interface (GND)	
X11	10	Modulating pump interface (+6V)	
X12	1	3-way Stepper driver – COIL1 +	< 10m
X12	2	3-way Stepper driver – COIL1 -	
X12	3	3-way Stepper driver – COIL2 +	
X12	4	3-way Stepper driver – COIL2 -	
X13	1	WP sensor (5V)	< 1m
X13	8	WP switch/sensor (input)	
X13	2	WP switch/sensor (GND)	
X13	9	FLOW sensor (6V)	< 1m
X13	3	FLOW switch/sensor (input)	
X13	10	FLOW switch/sensor (GND)	
X13	4	DHW sensor (input)	> 10m (for storage appl.)
X13	11	DHW sensor (GND)	
X13	5	CH return sensor (input)	< 1m
X13	12	CH return sensor (GND)	

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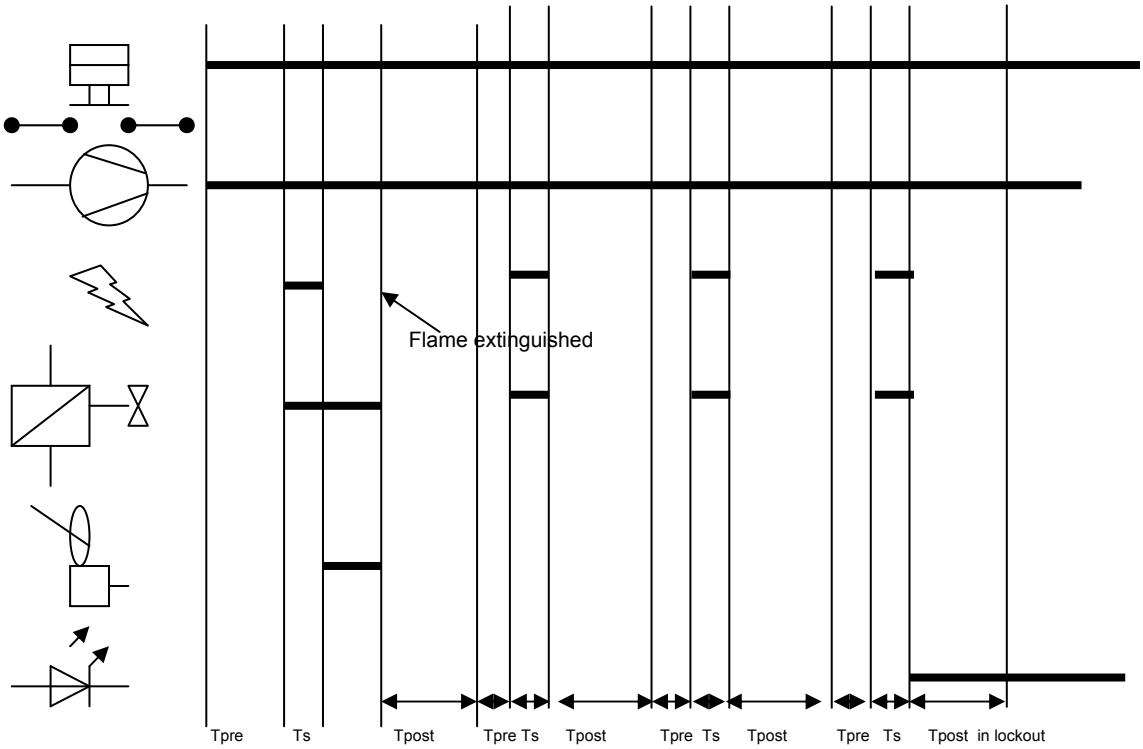
Conn.	Pin#	Description	Length
X13	6	CH1 supply sensor (input)	< 1m
X13	13	CH1 supply sensor (GND)	
X13	7	HL switch or CH2 supply sensor (input)	< 1m
X13	14	HL switch or CH2 supply sensor (+24V)	
X14	1	Flue sensor/TTB (input)	< 1m
X14	5	Flue sensor/TTB (GND)	
X14	2	Outside temperature sensor (input)	> 10m
X14	6	Outside temperature sensor (GND)	
X14	3	Open Therm (input)	> 10m
X14	7	Open Therm (GND)	
X14	4	Solar sensor (input)	> 10m
X14	8	Solar sensor (GND)	
X15	1	Interface DSP (+24V)	< 3m
X15	2	Interface DSP (RX)	
X15	3	Interface DSP (+6V)	
X15	4	Interface DSP (GND)	
X15	5	Interface DSP (TX)	
X15	6	Interface DSP (sensor)	
X16	1	Interface with simple MMI (clk)	< 1m
X16	2	Interface with simple MMI (latch)	
X16	3	Interface with simple MMI (data)	
X16	4	Interface with simple MMI (trim.1)	
X16	5	Interface with simple MMI (trim.2)	
X16	6	Interface with simple MMI (+5V)	
X16	7	Interface with simple MMI (backlight)	
X16	8	Interface with simple MMI (+6V)	
X16	9	Interface with simple MMI (+24V)	
X16	10	Interface with simple MMI (GND)	
X17	1	Auxiliary Board (+24V)	< 1m
X17	2	Auxiliary Board (V6)	
X17	3	Auxiliary Board (+5V)	
X17	4	Auxiliary Board (SPI SS1)	
X17	5	Auxiliary Board (SPI SCK)	
X17	6	Auxiliary Board (SPI MOSI)	
X17	7	Auxiliary Board (SPI MISO)	
X17	8	Auxiliary Board (GND)	
X18	1	Clip in connection – +24V	< 1m
X18	2	Clip in connection – RESET	
X18	3	Clip in connection – RX-EX	
X18	4	Clip in connection – GND	
X18	5	Clip in connection – V6	
X18	6	Clip in connection – SPI SS2	
X18	7	Clip in connection – SPI SCK	
X18	8	Clip in connection – SPI MISO	
X18	9	Clip in connection – SPI MOSI	
F00		Earth connection	> 10m

Conn.	Pin#	Description	Length
F03/F01		Sparking or sensing cable	< 0.5m
	1	Cli-in Communication connector (signal)	> 10m
	2	Clip-in Communication connector (gnd)	

Product life

- 500.000 cycles for safety and main operator gas valve
- 250.000 cycles at rated loads
- 6.000 lock-out operations with rated loads

5.4 - Timing diagram



Tpre = Prepurge Time
Ts = Safety Time
Tpost = Postpurge Time

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5.5 - System Parameters list (default settings)

All the parameters can be accessed with a communication package running on the PC.
Some parameters are available by the installer TSP mode on the MMI or by the OT Room unit.

No.	Description	Range	Default	Data_ID
	CONFIGURATION			
	System Configuration: Bit 0 : 0=Monothermic; 1=Bithermic Bit 1: 0=TTB Switch; 1=TTB Sensor Bit 2: 0=WP Switch; 1=WP Sensor Bit 3 : 0=No APS; 1=APS Bit 4 : 0=CH/DHW boiler; 1=CH_ONLY boiler Bit 5 : 0=CH/DHW boiler; 1=DHW_ONLY boiler Bit 7: 0=No APS Check on modulation; 1= APS Check on modulation	0-255	**6**	14D6
	DHW Configuration: Bit 0 : 0=Instantaneous; 1=Storage Bit 1: 0=Electric 3-way; 1=Hydraulic 3-way Bit 2: 0=Flow sensor; 1=Flow switch Bit 3: 0=Honeywell flow sensor; 1=Fugas flow sensor Bit 4: 0=Storage standard, 1=Storage Thermostated Bit 5: 0=no 3WV stepper,1=3WV stepper Bit 6: 0=no Siphon Switch, 1= Siphon Switch Bit 7: 0=no 2 Pumps, 1= 2 Pumps	0-255	**1**	05C8
	Extended Configuration: Bit 0: 0=No Gas Pressure Switch; 1=Gas Pressure Switch Bit 1: NA Bit 2: 0=No Cascade; 1= Cascade Bit 3: 0=No Pair mode; 1= Pair mode (2 maXsys connected) Bit 4: NA Bit 5: NA Bit 6: 0= Gas Pressure switch on APS input; 1 = Gas Pressure switch on high voltage HD input Bit 7: 0= Antilegionella enabled; 1 = Antilegionella disabled	0-255	**0**	211C
	Display Mode: Bit 1: 0=Summer mode OFF; 1= Summer mode ON	0-255	**0**	0A37
	FAN CONTROL			
	Fan kP Up factor	0-127	**50**	0AC8
	Fan kI Up factor	0-255	**244**	0AF4
	Fan kP Down factor	0-127	**50**	1B8C
	Fan kI Down factor	0-255	**250**	1BB0
	Fan sensor for revolution 1…5 (where 0=2)	0-5	**3**	1D1C
	Minimum Fanspeed (rpm x 50)	6-255	**30**	0AAE
	Maximum Fanspeed (rpm x 50)	6-255	**114**	0AA1

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No.	Description	Range	Default	Data_ID
	Ignition level (%)	0-50	**35**	0908
	Customer Prepurge Time (sec)	0-255	**0**	0CA7
	Customer Postpurge Time (sec)	0-255	**10**	0CC1
	PostPurgeSpeed (rpm x 50)	6-255	**90**	22EF
	Stabilization Time (sec)	0-255	**4**	0CCE
	PostPurge delay (s) before using the fixed "PostPurge speed"	0-20	**7**	278C
	WATER PRESSURE			
	Water Pressure Conversion Factor A	0-255	**4**	09F7
	Water Pressure Conversion Factor B	0-255	**15**	09F8
	Water Pressure Conversion Factor C	0-255	**26**	0AC7
	Minimum Water Pressure (Bar*10)	0-10	**10**	0934
	Force Filling	0-255	**0**	2120
	CH MODE			
	CH kP Factor	0-127	**4**	05FB
	CH kI Factor	0-255	**228**	0607
	CH temperature setpoint (°C)	20-95	**80**	056D
	CH Maximum setpoint (°C)	20-95	**80**	0A9D
	CH setpoint Hysteresis (°C)	2-10	**3**	1275
	CH Slope Rate (°C/min)	0-60	**4**	0592
	CH anti cycling time (min)	0-15	**2**	05AE
	CH Pump overrun time (min.)	1-30	**5**	05C7
	CH Minimum Time (min)	0-10	**2**	1E2C
	CH Maximum Level (%)	0-100	**100**	063B
	CH Minimum Level (%)	0-100	**0**	2276
	CH OVT TIME (min)	0-10	**0**	35AD
	CH OVT HYSTADD (°C)	0-30	**0**	35C4
	DECREASE SLOPE			
	Min.power % (threshold) to start decreasing slope	0-100	**20**	22DC
	Time*0.2s for a step during decreasing slope	0-255	**10**	22E0
	TTB – FLUE			
	Minimum TTB trip point (°C)	80-110	**90**	050B
	TTB Cool Down time (min)	0-60	**10**	0537
	Maximum TTB temperature	90-120	**120**	27D6
	3 WAY VALVE			
	3-Way valve travel time (sec)	1-255	**8**	144F
	Parallel Mode	0-1	**0**	212F
	Manual Stepper Target (%)	0-100	**0**	2146
	OTC –OUTSIDE TEMPERATURE SENSOR			
	OTC Curve number	0-10	**0**	055E
	OTC Offset (°C)	20-70	**30**	0562
	DHW MODE			
	DHW temperature setpoint (°C)	35-90	**65**	05F4
	DHW storage thermostated setpoint (°C)	35-90	**80**	0907
	DHW setpoint Hysteresis (°C)	2-10	**3**	0C6B

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First release – from S4966V2029 rev B	MarPas	0060030	100107	A

No.	Description	Range	Default	Data_ID
	DHW kP Factor	0-127	**4**	066E
	DHW kI Factor	0-255	**228**	0691
	DHW Flow Delta Factor	0-255	**15**	069E
	DHW Pump Overrun time (min)	0-30	**1**	2BE9
	DHW Pump Overrun time (sec)	0-59	**0**	0A04
	DHW Flow On Frequency (Hz)	0-100	**18**	127A
	DHW Flow Off Frequency (Hz)	0-100	**14**	1285
	DHW Maximum level (%)	0-100	**100**	06F8
	DHW minimum level (%)	0-100	**0**	2279
	Max DHW setpoint for Extended range (°C)	65-90	**65**	1E76
	DHW Storage Offset (°C)	5-30	**5**	128A
	Storage DHW Overtemperature timer (sec)	0-255	**60**	24E6
	DHW delay Antihammer (sec)	0-10	**0**	0991
	APS			
	APS switching time (sec)	0-255	**50**	1ED3
	APS check fan speed (rpm x 50)	6-255	**114**	2175
	SOLAR			
	Solar sensor Antifreeze T° (°C)	1-8	**5**	2210
	Solar sensor Hysteresis + 5° T° (°C)	0-10	**4**	221F
	Solar sensor storage high limit T° (°C)	40-90	**65**	2223
	Solar sensor storage high limit Hysteresis T° (°C)	0-2	**0**	2245
	Solar tank high limit temperature (°C)	40-105	**80**	222C
	MODULATING PUMP			
	Delta T1 (maintaining level) °C	1-30	**18**	0A6D
	Delta T2 (protection level) °C	2-40	**35**	0A92
	CH modulating pump min %	1-100	**30**	22D3
	CH modulating pump start %	1-100	**40**	22BA
	CH modulating pump max %	1-100	**100**	22B5
	CH modulating pump step %	0-100	**5**	2289
	CH modulating pump update time (s)	0-100	**10**	2286
	HEAT EXCHANGER PROTECTION PARAMETERS			
	TM Time loop (Delta T protection) {s.}	0-100	**2**	2416
	TM Virtual power decrease step	0-255	**1**	2419
	TM Virtual power decrease time 2 {s.}	0-60	**2**	2425
	TM Virtual power decrease time 1 {s.}	0-60	**4**	242A
	TM Virtual power increase time {s.}	0-60	**6**	2443
	CH Time loop (Delta T protection) {s.}	0-100	**2**	244C
	CH Virtual setpoint decrease step °C	0-100	**1**	2470
	CH Virtual setpoint decrease time {s.}	0-100	**10**	247F
	DHW Time loop (Delta T protection) {s.}	0-100	**2**	2480
	DHW Virtual setpoint decrease time 2 {s.}	0-100	**12**	248F
	DHW Virtual setpoint decrease time 1 {s.}	0-30	**18**	24B3
	DHW Virtual setpoint increase time {s.}	0-100	**18**	24BC

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First release – from S4966V2029 rev B	MarPas	0060030	100107	A

No.	Description	Range	Default	Data_ID
	OTHER			
	Suspend mode	0-255	**0**	18B3
	Pump Control	0-255	**0**	059D
	Legionella Protection time on thermostated boiler	0-255	**15**	1DD0
	Siphon delay	0-60	**3**	217A
	Market zone (bit7=imperial units=e.g.. °F)	0-255	**0**	24DA
	Swap validation time	0-255	**180**	359E
	Swap Histeresys	0-50	**3**	35AE
	CASCADE / OT ID15			
	Maximum burner power (kW)	0-255	**250**	1D85
	Minimum Modulation Level (%)	0-100	**18**	224A

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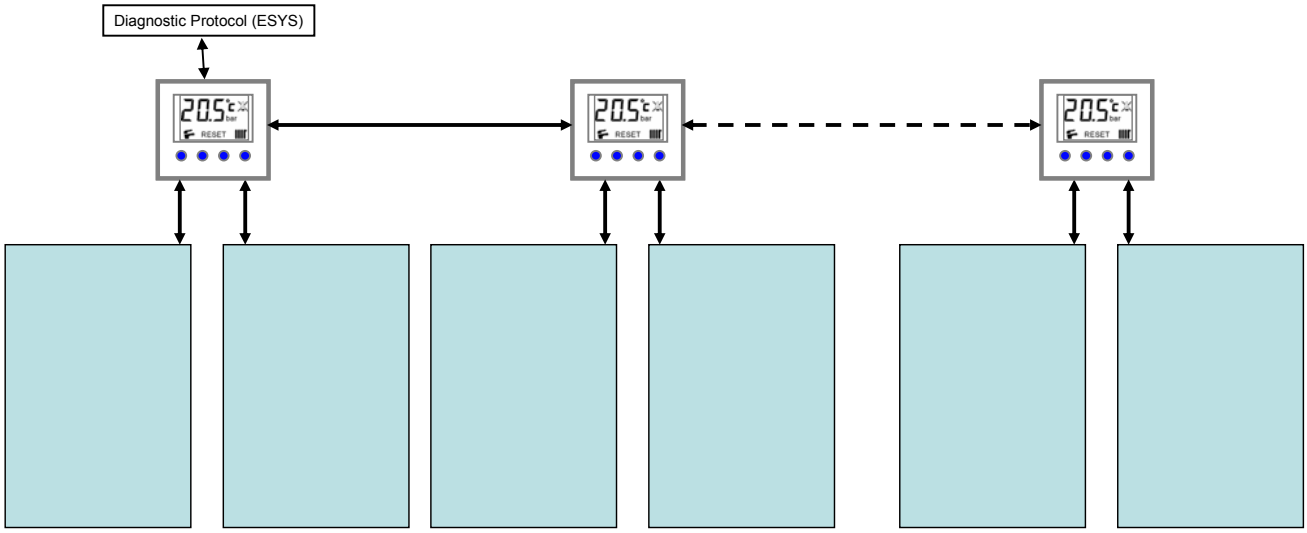
First release – from S4966V2029 rev B	MarPas	0060030	100107	A

5.6 – Cascade configuration

5.6.1 – System description



maXsys S4966V2052B has been designed to support cascade configuration in conjunction with DSP49G2060B.
Cascade functionalities have been implemented partly on the maXsys board and partly on the DSP.

Refer to functional description documents of DSP49G2060B for a complete understanding of how system works.

Cascade systems can be composed by DSP connected together, where first DSP will auto configure as Master of the chain and other DSP will configure as Slave. Each DSP can connect two maXsys boards: maXsys 0 and maXsys 1.
maXsys will automatically select to be maXsys 0 or 1, based on sensing connection of Outside sensor input and DHW sensor input.

maXsys 1:
(Outside sensor= Short) AND (sensor DHW=open).

maXsys 0:
If at least one of the conditions above are not matched -> maXsys 0

maXsys will know to be in a cascade configuration when receiving Bit 2 of ‘Extended Configuration’ from Cascade DSP connected.

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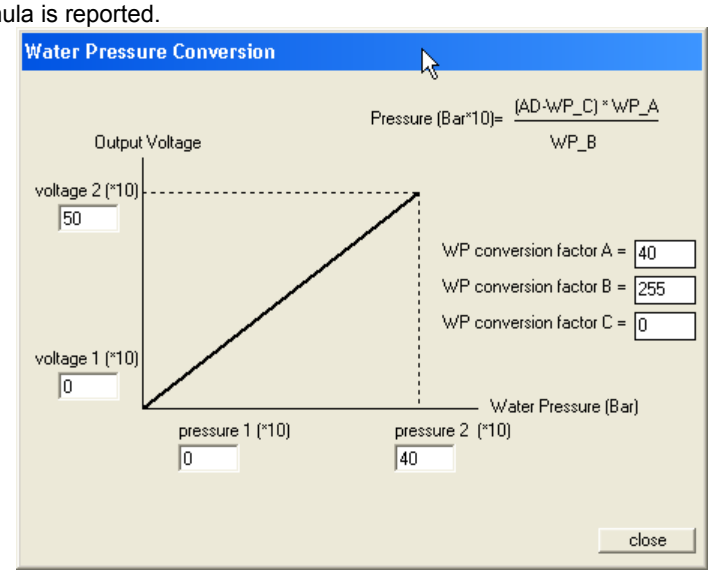
5.6.1 – Water Pressure sensor/switch

When in cascade configurations a water pressure can be connected to maXsys.
When configured in cascade with two burners for boiler only one water pressure sensor/switch is connected for each boiler.
The WP is connected to the first maXsys board (maXsys 0). In case of water pressure failure both burners of the boiler have to be stopped.

In maXsys the formula to calculate water pressure conversion is depending on parameters WP conversion factors A, B and C.
In the picture below the formula is reported.



5.6.2 – DHW Siphon sensor

maXsys supports check of Siphon sensor input.
It can be connected to DHW flow input and configured with parameter Bit 6 of 'DHW Configuration'.
When configured in cascade with two burners for boiler, only one Siphon device is connected for each boiler. In this case The Siphon is connected to the first maXsys board (maXsys 0).
In case Siphon is connected, the DHW flow of the boiler can be connected to MaXsys1. In case Siphon is not used, DHW flow sensor/switch will be connected to MaXsys0.
If the Siphon switch is closed the boiler run in normal mode. If the switch is opening the boiler has stop (blocking condition).
When configured in cascade with two burners for boiler and switch opening both burners have to be blocked.

5.6.4 – TTB in case of cascade

When maXsys is configured in cascade with two burners for boiler, the TTB flue sensor is connected to the first maXsys board (maXsys 0).

5.6.5 – Cascade Mode

When configured in Cascade system (with DSP49G2060 MMI) a Cascade Test Mode can be started from MMI.
Cascade CH Mode:

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In the CH Cascade mode the fanspeed is regulated between minimum and maximum fanspeed based on power % received from MMI. The 3-way valve will be set to CH position in this mode. The burner will first ignite in a standard manner, and will then go to a fanspeed between minimum and maximum. During Cascade CH mode the temperature of the CH circuit is monitored, and as soon as the CH sensor reaches 97°C the burner is switched off, and will be switched on again as soon as CH sensor reaches 81°C.

Cascade DHW Mode:

In the DHW Cascade mode the fanspeed is regulated between minimum and maximum fanspeed based on power % received from MMI. The 3-way valve will be set to DHW position in this mode. The burner will first ignite in a standard manner, and will then go to a fanspeed between minimum and maximum. During cascade DHW mode both temperatures of CH circuit (supply) and DHW sensor are monitored. As soon as the CH sensor reaches 97°C OR DHW sensor reaches 95°C the burner is switched off, and will be switched on again as soon as CH sensor reaches 81°C AND DHW sensor less or egual to 90°C.

6 - Modes of operation

The controller has a number of basic modes of operation:

- Start Up, after power on or reset.
- STANDBY, when there is no heat demand
- DHW-MODE, when domestic hot water flow is detected by the flow sensor/switch.
- CH-MODE, when an external Heat Demand is received.
- DHW FROST PROTECTION, special DHW-type heat request to protect the system against freezing.
- CH FROST PROTECTION, special CH-type heat request to protect the system against freezing.
- TEST MODE, option for the installer to test performance of the boiler.
- ERROR/FAULT conditions like over temperature conditions, sensor faults etc
- SUSPEND MODE, status where only some functionalities are possible

The priority of operating modes is fixed as following:

1. Error / Fault mode
2. Test mode
3. Suspend mode
4. DHW mode
5. CH mode
6. DHW Frost mode
7. CH Frost mode
8. Stand-by mode (Idle)

In case of normal operation in DHW or CH mode and no error conditions it is always possible to enter the installer TEST mode as higher priority mode of operation. If there was an over-temperature condition, installer TEST mode can be entered after normal operating conditions are reached again.

6.1 - Start up

After Power On or manual reset the control will perform its start up routines.
The 3-way valve is moved to CH position (default position), then moved to DHW position till 20 seconds start up period has elapsed. Directly afterwards it is driven to CH position again, regardless of the previous position.
During a 20 seconds start up period the 3-way valve is forced to DHW position and directly afterwards to CH position again (default position), regardless of the previous position. This way it is ensured that the 3-way valve will at least travel from one side to the other preventing sticking of the 3-way valve. Also the pump is switched on during this start up time preventing sticking of the pump.
Every 12/24 hours maXsys performs a check on safety features (not a complete start up routine). 12/24 hour reset depends on whether a heat demand is present. When no heat demand is present the control will perform a reset 12 hours after the last one. When a heat demand is present, the control will wait a maximum of 24 hours to perform the reset.

6.2 - Stand by

In STAND-BY mode igniter is off, gas valve is closed and pump is off if pump over-run time is finished.

6.3 - Test Mode

The Installer Test mode can be started by external communication or with a display connected to the maXsys.

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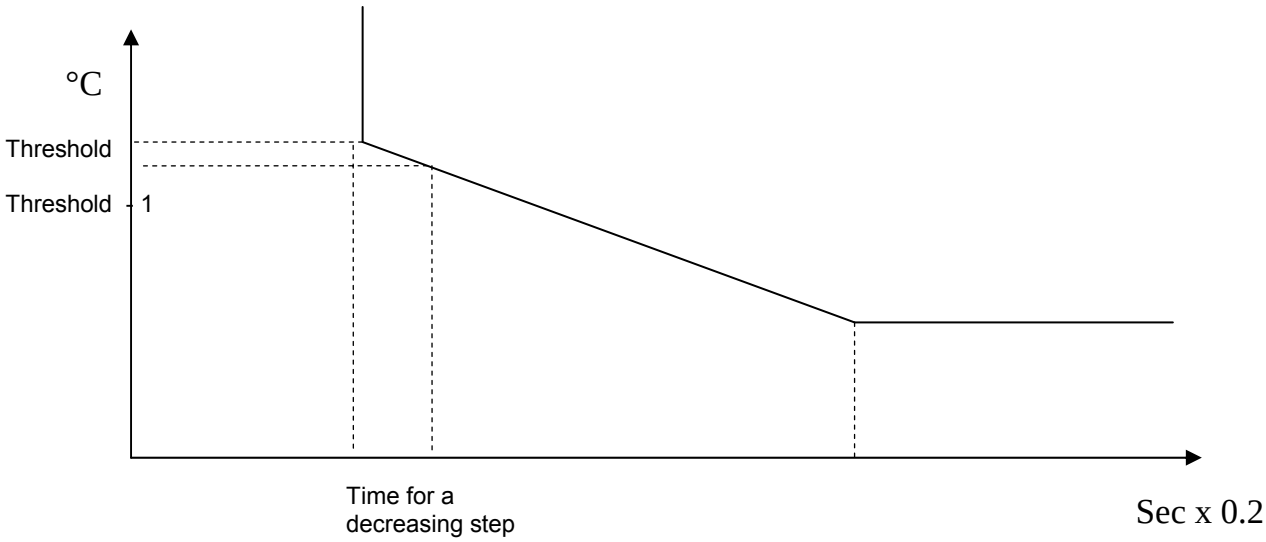
When controller in used in Cascade systems, connected to DSP49G2037B, it is driven by DSP in power mode as done during TestMode.
Test Mode can be either CH Test Mode or DHW Test Mode, based on command sent (via trimmer or Control Panel).
In the Test mode the fanspeed can be directly regulated between minimum and maximum fanspeed. The 3-way valve will be set to the position of the selected Mode (CH or DHW). The burner will first ignite in a standard manner, and will then go to a fanspeed between minimum and maximum. Refer to 5.6.5 Cascade Mode for details on temperature threshold.

In cascade systems and when a Flapper Valve is configured, a Decreasing slope algorithm is implemented to avoid flapper fall. This is due because too rapid decreasing of fan speed would cause flapper to close.
Decreasing slope works as configured by following class 5 parameters:

- Threshold (power %) starting point of the “decrementing” slope.
- Time for a decreasing step (*0.2 seconds)

Refer to following picture.



6.4 - Suspend Mode

Suspend Mode can be started by external communication or with a MMI display connected to the maXsys. In Suspend Mode only following features can be activated: CH and DHW Frost protections and the 12/24 hour protection of the pump and 3-way valves seasonal exercise.

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6.5 - DHW Mode

Selection between instantaneous and storage mode is performed with parameter list, see section.

6.5.1 - DHW instantaneous

maXsys S4966V2052B can accept DHW Instantaneous demands only when configured as stand alone burner controller. When in cascade configurations, DHW Instantaneous demands will not be accepted.

In case of no error condition and when a valid water flow is measured, boiler is active in DHW mode. DHW flow can be detected by a water flow sensor or switch, depending on parameter settings. When a flow switch is selected, DHW flow is detected as soon as the switch closes. In case a flow sensor system is selected, the flow on/off detection rates can be set in parameters. The flow rate detection upper limit depends on the Flow sensor type used, but is limited to 100Hz.
If Monothermic boiler type is selected the pump will run and the 3-way valve will be set to DHW position.
The controller will start to ignite when the DHW temperature is lower than the DHW setpoint. (the controller will not start to ignite for DHW mode if DHW temperature is greater than the DHW setpoint). When the DHW temperature reaches setpoint + hysteresis, burner will be switched off. At the end of the DHW mode (DHW flow is below Flow Off level set in Parameter), normal pump overrun takes place if winter mode is selected.
Refer to Figure 1 for an overview of instantaneous DHW heating control behavior.

Modulation is accomplished with a feed forward and PI control algorithm.
Variables used for control in DHW mode:

a) ***User DHW setpoint*** - requested water temperature, programmable via external communication.
b) ***Actual DHW water temperature*** – measured on the DHW sensor
c) ***Water flow frequency*** - measured value from the water flow sensor in order to determine
start and stop conditions for the heat demand generated with this sensor, and feed forward control (only for flow sensor systems).

If during the normal DHW operation, DHW water temperature becomes higher than 75°C or higher than DHW Setpoint + DHW Hysteresis, the ignition controller switches off. After DHW temperature is <= User DHW setpoint temperature and there is still a flow detected, boiler will continue with normal operation.

Because of the fact that both sensors (CH, DHW) are simultaneously scanned for overtemp condition, DHW operation will also stop if temperature measured on the CH sensor becomes higher than the CH protection temperature level of 95°C, and will be started again as soon as CH sensor reaches 80°C.

The setpoint adjustments are always in between the absolute minimum (35°C) and the absolute maximum value determined by 'Max DHW setpoint for Extended range' parameter (65-90°C).
For Bithermic boiler systems the activation of Installer Test demand is blocked when DHW demand is active.

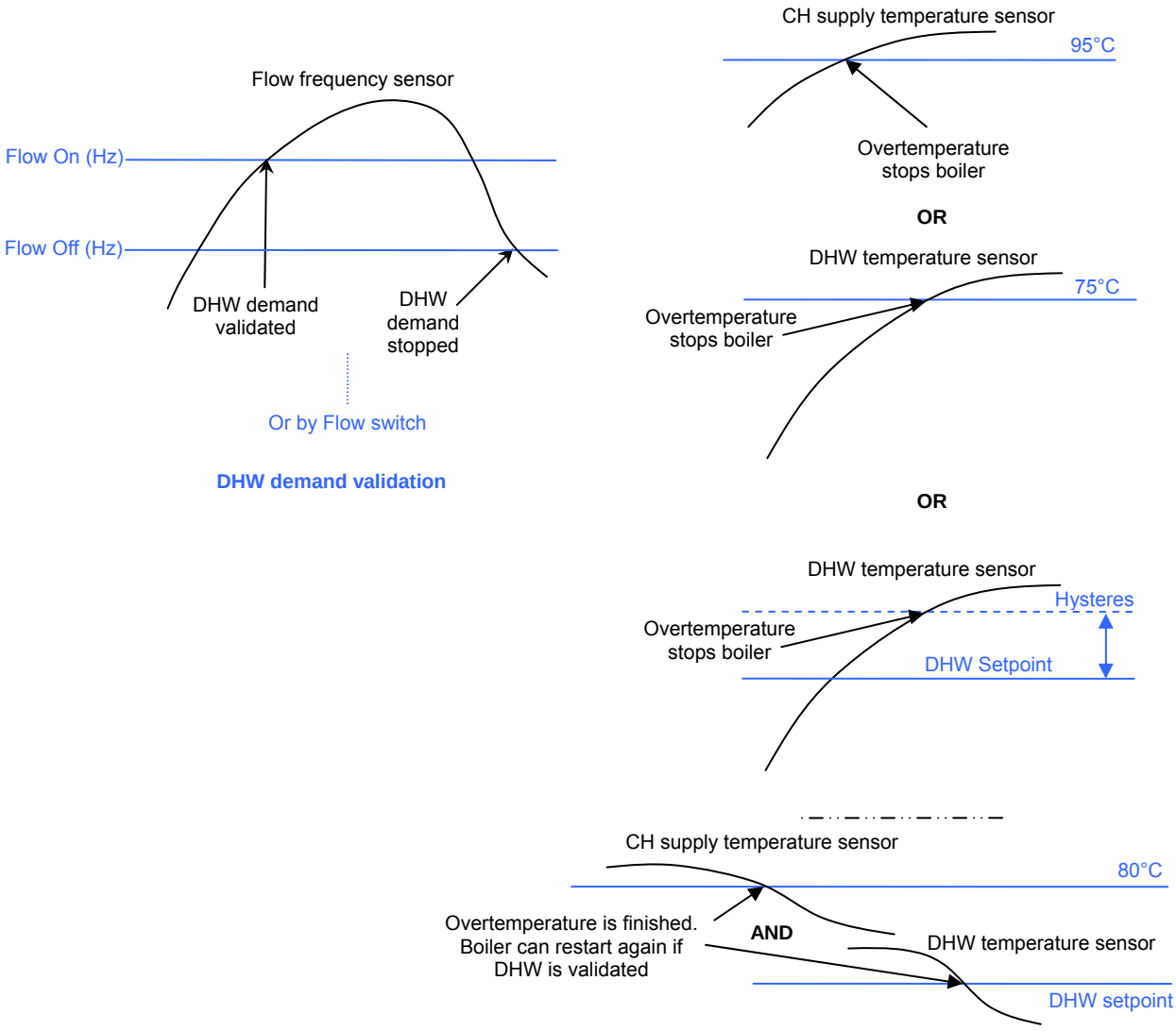

Figure 1

6.5.2 - DHW storage mode

Instead of an instant hot water system, a hot water storage tank is also supported. The water in the storage tank is heated through the spiral where the CH water flows.
The boiler can support sensor or switch configuration to generate DHW demand (see paragraph 6.15.7 for automatic sensor/switch detection). Water flow sensor is not used any more.
Refer to Figure 1 for an overview of storage DHW heating control behavior.

In case of no error condition and when the heat demand is detected by DHW switch, the control is as follows:
Start DHW demand: DHW switch is closed

Stop DHW demand: DHW switch is open

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In case of no error condition and when the heat demand is detected with DHW temperature sensor, the control is as follows:
Start DHW demand: Tdhw_storage < DHW setpoint - DHW hysteresis

The boiler stops if the storage temperature becomes higher than the setpoint:
Stop DHW demand: Tdhw_storage > DHW setpoint

DHW hysteresis is programmable in Eprom.

The capacity used for warming up the storage boiler is depending on the primary CH supply temperature sensor and it is adjusted by using PI control principle.
In case of DHW sensor, the Primary setpoint value is set to DHW setpoint + DHW Storage Offset (see parameters 'DHW temperature setpoint', 'Max DHW setpoint for Extended range' and 'DHW Storage Offset') and it is limited to maximum value of 93°C.
In case of DHW Thermostated (DHW switch), the Primary setpoint value is set to DHW storage thermostated setpoint (°C) (see Parameter) and it is limited to maximum value of 93°C.

The boiler will be switched off when the CH temperature reaches 97°C or when it becomes greater than Primary setpoint +5°C, and will continue with normal DHW operation as soon as CH sensor becomes less than Primary setpoint again AND less than 91°C.
Pump and PWM pump are active in storage mode, and 3-way valve position will be set to DHW circuit. After pump overrun time, pump and PWM pump will stop and system will return to the default position (CH circle).

The Antilegionella function is implemented and is active weekly.
If the storage is thermostated type (bit4=1 in DHW Configuration), the Antilegionella is activated once a week. In this case the Legionella protection time (see Parameter list) is loaded and the boiler starts a DHW demand (with DHW Setpoint fixed to 80°C) till Legionella protection time is not elapsed.
If the storage is standard type (bit4=0 in DHW Configuration), the Antilegionella is activated when the week timer is elapsed. In this case the boiler starts a DHW demand (with DHW Setpoint fixed to 80°C) till the DHW sensor will reach 60°C. Moreover, to prevent unnecessary energy consumption, the week timer is refreshed whenever the DHW sensor will reach 60°C.

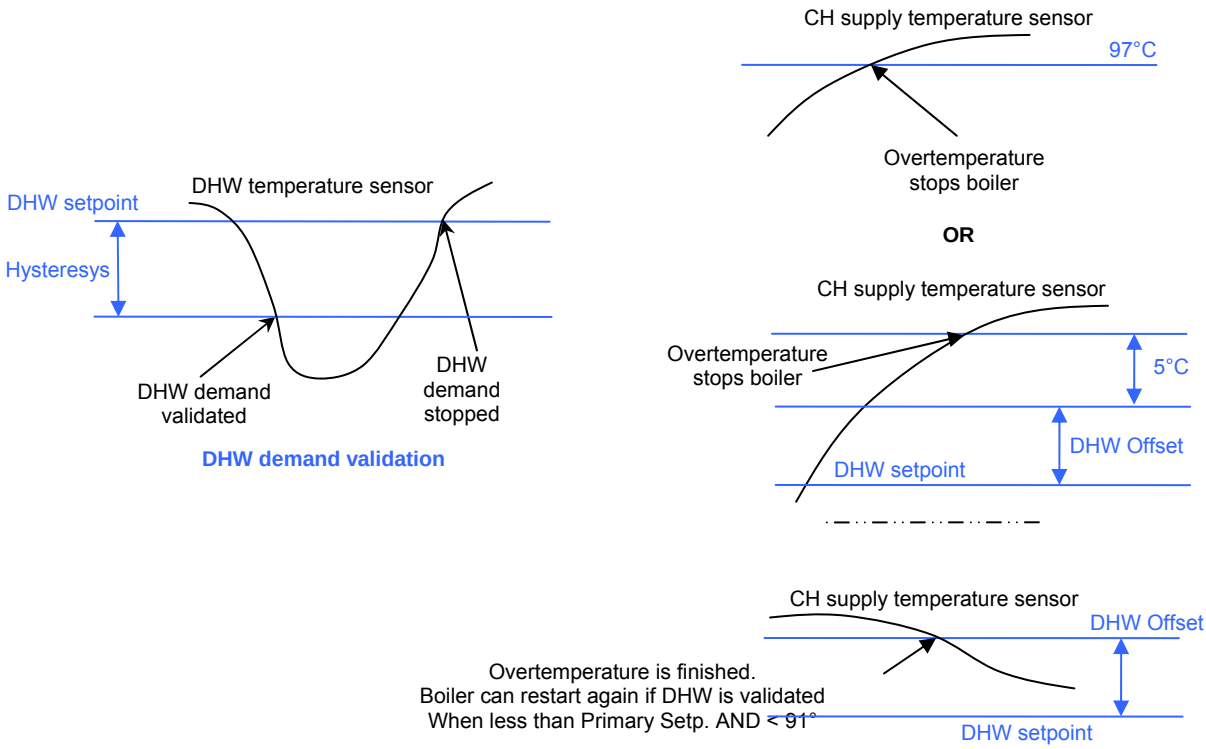

Figure 2 – DHW demand in case of DHW sensor

6.6 - DHW Frost protection

If no other heat demand is active and the DHW temperature sensor measures a low temperature (lower than 6 °C), the boiler will start as if there was a DHW demand. When the DHW water temperature goes above 15°C (measured on the DHW sensor), the heat demand will end. During frost protection the burner will at a fixed low level.

Because of the fact that both sensors (CH, DHW) are simultaneously scanned for overtemp condition, DHW operation will also stop if temperature measured on the CH sensor becomes higher than the CH protection temperature level of 95°C and will continue with normal DHW operation as soon as CH sensor reaches 81°C again. Pump overrun is done following DHW cycles demands.

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6.7 - CH Mode

CH mode is entered when a Heat Demand is received on input of maXsys, or when an external Heat Demand is received via external communication. The CH setpoint is always limited by parameter CH Maximum Setpoint (useful to limit the setpoint in case of undersfloor applications.)
The boiler will pump through the CH circle as long as the heat demand is valid, and the 3-way valve will be set to CH position. The burner is switched on when the CH temperature is lower than CH setpoint (controller will not start a CH mode if temperature is greater than the CH setpoint), and switched off when CH temperature is higher than CH setpoint + hysteresis or 97°C. The CH setpoint can be the fixed CH setpoint programmed as parameter, or an external setpoint received by external communication. When ignition is successful, maXsys will modulate to the setpoint at the Minimum power for time='CH Minimum Time' parameter. After that will reach the setpoint with a settable slope.
If the heat demand is ended the burner will be switched off and the pump will perform over-run. Pump over-run time is programmable as parameter (see list).
Refer to Figure for an overview of CH control behavior.

During the heat demand an overtemperature control is performed: boiler will be switched off when CH sensor is greater then 95°C or greater setpoint + histeresys. Then boiler will be switched on again when Ch sensor is less then Setpoint AND less then 81°C. When switched on again from overtemperature, an overshoot function is enabled: CH Histeresys is increased of CH OVT HYSTADD parameter value for a time set in CH OVT TIME parameter.

When boiler is configured as Bithermic and CH mode is active, then the control will act in the following way to prevent user to be hurt: if DHW flow sensor is used, CH setpoint will be forced to 60°C as soon as a flow rate is detected as higher than 3Hz (e.g.: due to the tap remained open); if DHW flow switch is used, CH setpoint will be forced to 60°C as soon as the switch closes.

When controller in used in Cascade systems, connected to DSP49G2060B, it is driven by DSP in power mode (as in Test Mode). Refer to DSP functional specification for further details of cascade algorithm.

6.8 - CH Frost protection

When there is no heat demand from any of the above mentioned resources, and the CH sensor measures a low water temperature in the system (less then 6°C), the boiler will start as if there was a CH demand. When the CH water temperature goes above 15°C (measured on the CH sensor), the CH demand will end. During frost protection the burner will run at a fixed low level. Pump overrun is done following CH cycles demands.

6.9 - Pump Behavior

Depending on the mode of operation and the chosen configuration, the pump will behave differently.

6.9.1 - Pump behavior in Standby mode

When the system is in standby mode, normally the pump will be off. However the pump can run in the following situations:
-pump overrun is active. When a CH or DHW heat demand is ended, the pump will continue to run for a certain time.
-If the temperature of the CH sensor goes above 85°C, the pump will switch on. It will continue to run until the CH temperature sensor goes below 80°C again.
-If the temperature of the CH sensor goes below 8°C, the pump will switch on. It will continue to run until the CH temperature sensor goes above 10°C.
-When an error is present, the pump will be switched on. Only exception to this is when a low water pressure error is present. (to keep the pump from running 'dry').

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First release – from S4966V2029 rev B	MarPas	0060030	100107	A

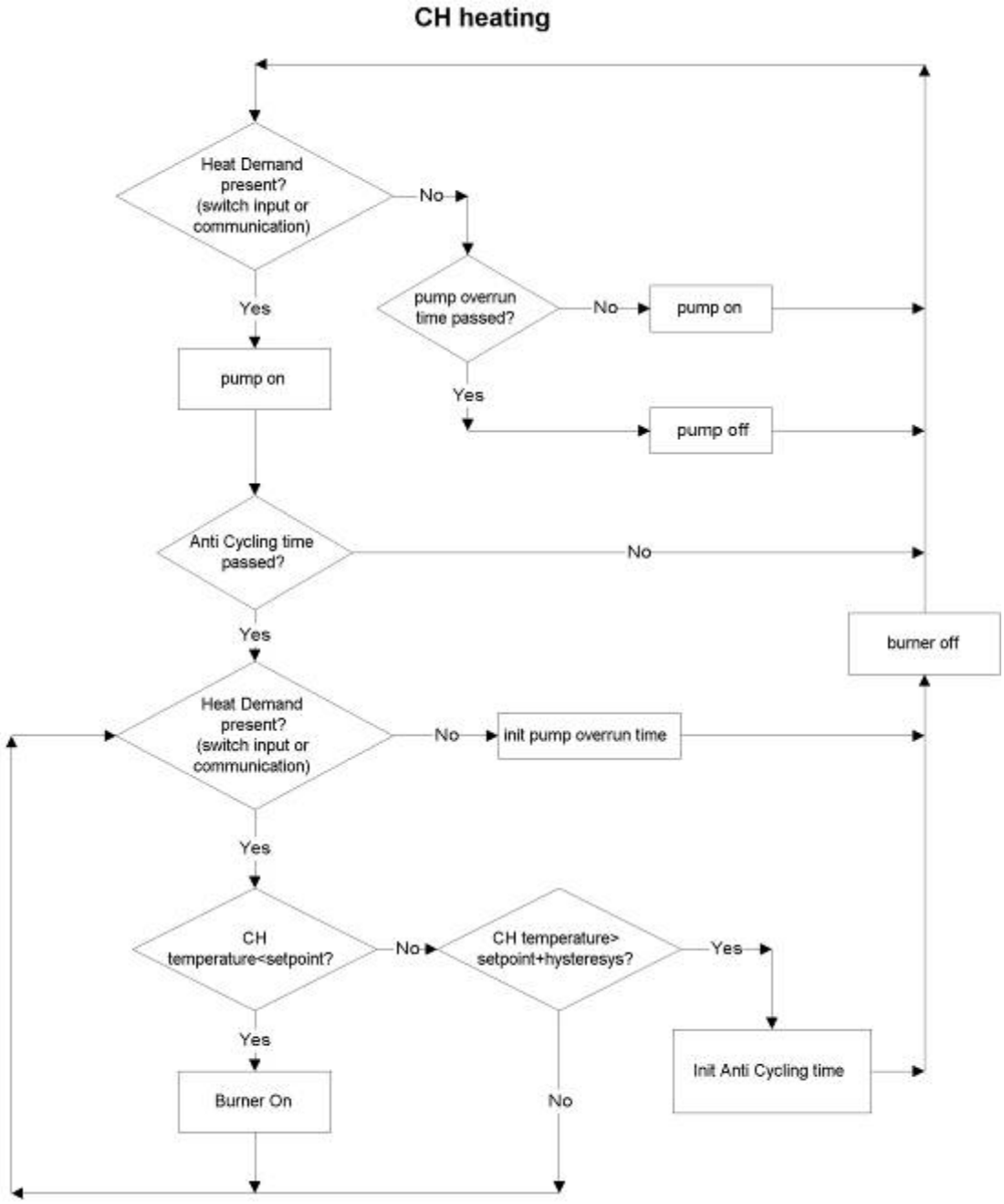

Figure 3

Note: 3-way valve default position in standby mode is CH circuit. No other heat demand is present in this flowchart.

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6.9.2 - Pump behavior in DHW mode

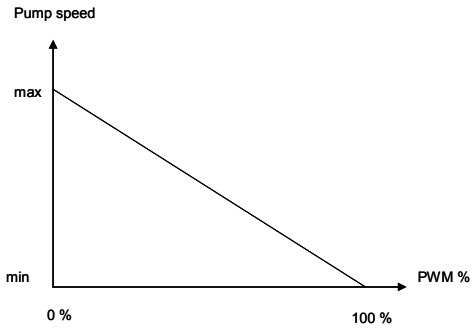
When the system enters DHW mode the pump will only switch on during heating if the boiler is configured as a Monothermic system (see parameter list). When the DHW heat demand is ended, the pump action depends on the system configuration. The following situations can be distinguished:
- winter mode: normal pump overrun, defined by parameter either on Monothermic or Bithermic boiler
- summer mode, pump overrun 1 second, to prevent sticking of the pump when bithermic boiler is selected. On Monothermic boiler pump overrun is not supported.

6.9.3 - Pump behavior in CH mode

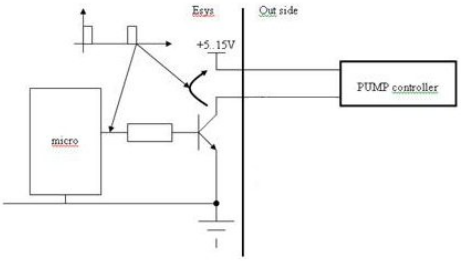
CH heat demand is supported only in Winter mode. During a CH heat demand, the pump will always run. When a CH demand is ended, the pump will continue to run for a number of minutes defined by the CH pump overrun parameter.
When a CH demand is present but no heat demand yet (the Actual CH temperature is above the CH setpoint) the pump will also run.

6.9.4 - PWM Modulating Pump output

The control logic inside the sw supports PWM pumps that work following the control curve reported below:



The circuit logic to drive the pump is reported below:



An increasing duty cycle signal from micro (sw control logic) will generate an increasing draining current through transistor, that will generate an increasing speed in the pump.
The signal frequency is at approximately 195 Hz.

In heating mode control logic will follow the CH pump control logic described above.

It will be driven based on below description:

Description	Ope.	ECO	Date	Rev.
Update declaration of conformity	MarCan	0098381	27-Feb-2013	C
Sw upgrade: new supply/return sensor mng, new Simpler MMI mng, various functional changes on customer request.	MarPas	0089869	120607	B
First release – from S4966V2029 rev B	MarPas	0060030	100107	A

- DHW Mode and Test Mode -> 100%
- CH Mode start up or with burner off -> CH start-up %
- CH cooling / overrun -> keep last pwm value.
- CH Mode running and CH Cascade -> see modulating pump regulation algorithm below.

Modulating pump regulation algorithm:

- If DeltaT (°C) > DeltaT1+1(°C) -> algorithm will increment pump speed (step%)
- If DeltaT (°C) < DeltaT1-1 (°C) -> algorithm will decrement pump speed (step%)
- If DeltaT (°C) > DeltaT2 (°C) -> pump speed = maximum pump speed (%).

6.9.5 – 2Pumps configuration

When bit7=1 in DHW Configuration parameter (see parameter list), the boiler is configured to work by two pumps (CH and DHW pumps) instead of a 3way valve. Management for electric or hydraulic 3way valve will be inhibited and 3Way valve relays will be used to drive the two pumps. When a DHW demand is present, the DHW pump will be turned on till DHW mode is active (post-circulation pump included). When a CH demand is present, the CH pump will be turned on till CH mode is active (post-circulation pump included).

6.10 - APS (Air Pressure Switch) function

If the APS is configured, the ignition is not started until the APS switch has performed an open and close sequence. Also the APS check during modulation can be controlled. Please find below in the table the options and the descriptions.

Function	Description
APS	Before the ignition is started the APS must have had an open (during fan off) and close (during fan on) status.
No APS	The ignition is started without checking the APS status
APS mod. Check (only enabled if APS function is enabled)	The APS is also checked during modulation. If the APS switches off a restart is performed (max 4 retrials).
No APS mod. Check (only enabled if APS function is enabled)	The APS is not checked during modulation. If the APS switches off nothing will happen, the control remains modulating. At the next heat demand, the APS is checked again.

With the APS switching time parameter the maximum time can be set on which the control may wait until the APS opens or closes. If the expected state of the APS is not fulfilled within this time, a lockout error will be set and a reset is required.

6.11 - Outside Temperature Control

The maXsys Controller will convert the Analog/Digital conversion result to the corresponding temperature. This is done trough a special lookup table between the limits of –30 to + 70 degrees Celsius. This is the standard used 8-bit lookup table.

The controller calculates and uses a Control Temperature Setpoint for Central Heating when an Outside Temperature Sensor is connected and OTC curve number is NOT 0. The value of Control Setpoint is limited to the maximum of the CH Setpoint range.

For calculating this Control Temperature Setpoint, the following calculation is done:

Control Temp. Setpoint = OTC Offset + C1 *(20 – Outside Temperature) / 4

Where:

C1 = derived from the OTC Curve number:

If OTC Curve number = 1..7 then C1 = OTC Curve number

If OTC Curve number = 8, then C1 = 9

If OTC Curve number = 9, then C1 = 12

If OTC Curve number = 10, then C1 = 18

For Outside Temperatures above 20 degrees Celsius, Control Temp. Setpoint = OTC Offset .

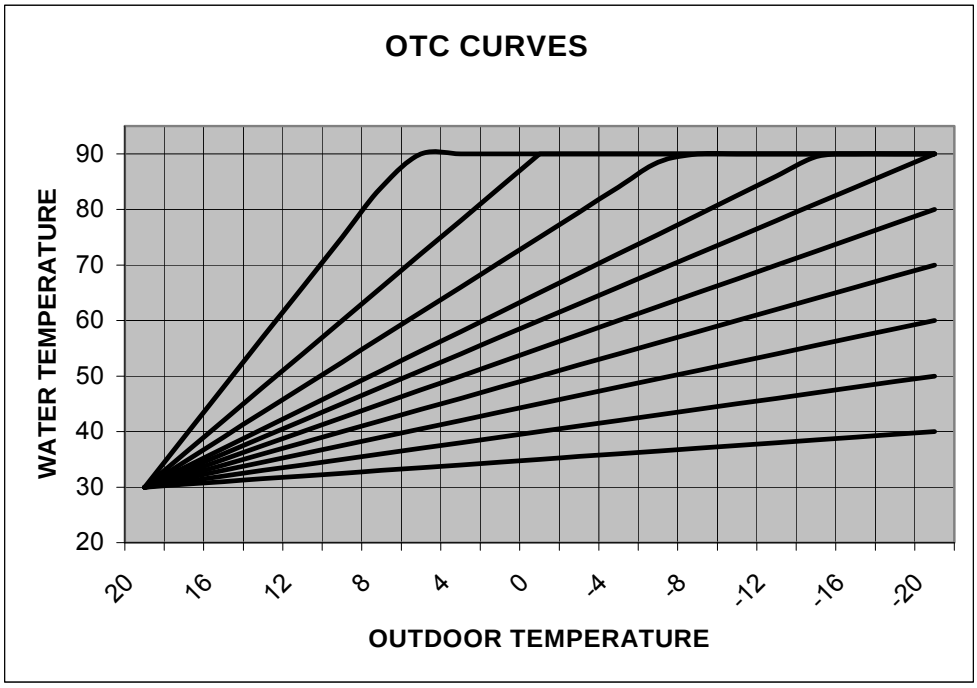


Figure 4 - Control Temperature Setpoint (Water Temperature) in relation to the Outside Temperature

6.12 - OpenTherm Communication Requirements

The maXsys is a slave in the OpenTherm Communication. This is used to connect OpenTherm Master devices. The supported ID's (application layer) are listed in "Supported OpenTherm Message ID's".

The maXsys uses a Microprocessor's falling and rising detection Interrupt pin for Receive (Rx) and a Microprocessor's PWM Timer output pin for Transmit (Tx). Further specification of the OpenTherm protocol is done in the document "The OpenTherm Communications Protocol – Protocol Specification".

When OpenTherm unit is connected, the following rules are followed to enter setpoint by maXsys:

Due to Remote communication structure, when the user changes the setpoint on OT unit, the OT unit will 'write' on maXsys the new values. When this happens user can not change setpoint on maXsys because it is inhibited.

The Control Setpoint Temp. is limited by CH setpoint range.

Supported OpenTherm Message ID's

Class	ID	R/W *	Description
1	0	R	Status
	1	W	Control setpoint
	5	R	Fault flags/ faultcode
2	2	W	Master configuration (dummy write)
	3	R	Slave configuration
3	4	W	Lockout reset
4	17	R	Relative modulation level
	25	R	CH water temperature
	26	R	DHW water temperature

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	27	R	Outside temperature
	28	R	CH return water temperature
5	6	R	Remote parameters transfer-enable read/write flags
	48	R	DHW setpoint bounds
	49	R	CH setpoint bounds
	56	R/W	DHW setpoint
	57	R/W	CH setpoint
7	12	R	Size of fault history buffer
	13	R	History fault
8	14	W	Maximum relative modulation level

* Read means: read by OT from MMI
Write means: written by OT to MMI

6.13 - Protection and error conditions

Several checks are included to protect the boiler and its environment. The water pressure switch/sensor is monitored permanently for primary water condition check, temperatures are monitored permanently if they are in range, safety times are constantly compared etc.
Any violation of (programmable) limits (and/or internal thermostat functions) will lead to an error/fault or warning condition. This can condition can be read out via external cvbc communication, or can be shown on a display. Severe error (igniter lockout) will cause a lockout condition which can only be cleared by the reset key on the room unit (or locally at the boiler front panel). Non severe errors/faults (i.e. sensor out of range) will reset as soon as the cause of the problem disappears. In case of lockout and blocking conditions, fan will not operate. Also in case of low water pressure, pump will be disabled. Refer to above chapters for a detailed description of protection modes.
Complete list of errors is given as following:

01	Flame lockout after several ignition trials
02	False flame signal
03	High Limit error
04	APS not closing error
05	Not tacho signal received when fan is controlled.
06	APS not opening error
07	TTB (Exhaust protection) activated
08	Flame circuit error
09	Valve driver circuit error
15	Drift test error
81	Drift test Warning
16	Stuck-at test error on supply sensor
17	Stuck-at test error on return sensor
18	Cracked sensor test error
80	Supply-Return reversed
13	Remote Reset Error
21	ADC error
25	CRC error
30	CH sensor error short
31	CH sensor error open
32	DHW sensor error short
33	DHW sensor error open
34	Low mains voltage
37	Water pressure low error

41	Water pressure signal timeout
43	CH return sensor error short
44	CH return sensor error open
45	TTB sensor error short
46	TTB sensor error open
47	Water Pressure Sensor not connected or broken
74	Solar sensor SHORT
75	Solar sensor OPEN
76	Gas Pressure Error
77	Siphon input

Error codes can be divided in 2 groups:

1. Lock-out condition codes
2. Blocking condition codes

Lock out condition codes

Lock out condition codes requires a manual reset action. The meaning of the error numbers is as following:

FAULT 1 = Lock out signal after no flame and all ignition trials are expired. This error condition is stopping the boiler and to get to the normal operation again, manual/remote reset is required. By using the local reset key, number of resets is not limited. However all remote resets (communication or OpenTherm) are limited to 5 resets per hour.

FAULT 2 = False flame signal. A flame signal is seen without the gasvalve being open.

FAULT 3 = High limit signal coming from the high limit temperature check on CH sensors supply and Ch sensor return. If one of the two temperatures is higher than 105°C, an error is generated. A High Limit error can be generated even after a condition of CH sensor supply or return sensor short condition is generated.

FAULT 4 = APS Error – If the APS is configured and the APS does not close or does not open within the configured time limits (see 'APS switching time'), Error 4 is generated.

FAULT 5 = Tacho Error. The control requires a certain fan speed, but does not detect a (correct) tacho signal.

FAULT 6 = APS Error – If the APS is configured and it drops during burner on and the number of maximum retrials has been reached, Error 6 is generated.

FAULT 9 = Valve circuit error - during normal operation of the ignition controller, valve circuit is regularly checked. This check has predictable behavior and several steps. If check fails, error 9 will be set. When the error is resolved, error will disappear.

FAULT 15 = Drift test error (lockout error) – refer to Appendix A for further information

FAULT 16 = Stuck-at test error on supply sensor (lockout error) – refer to Appendix A for further information

FAULT 17 = Stuck-at test error on return sensor (lockout error) – refer to Appendix A for further information

FAULT 18 = Cracked sensor test error (lockout error) – refer to Appendix A for further information

FAULT 80 = Supply-return reversed error (lockout error) – refer to Appendix A for further information

FAULT 13 = All remote resets (communication) are limited to 5 resets per 15min. If the limit is exceeded, error will be generated and to reset it, power off/on is necessary.

FAULT 30 = CH sensor out of normal operating range (short circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again (a lockout reset is necessary).

FAULT 31 = CH sensor out of normal operating range (open circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again (a lockout reset is necessary).

FAULT 43 = CH return sensor out of normal operating range (short circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again (a lockout reset is necessary).

FAULT 44 = CH return sensor out of normal operating range (open circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again (a lockout reset is necessary).

Blocking codes

The boiler controller recognizes also the fault situations that can block the heat demands but do not lead to lockout condition. When the error condition becomes resolved, error will disappear but will also be written into the history data. The meaning of these codes is as follow:

FAULT 7 = TTB protection. When the temperature measured on the TTB exhaust sensor becomes too high, this error will be activated. The TTB 'trip point' is the value which defines when the TTB sensor is too high, and changes depending on burner load. Refer to
Figure 4 - TTB protection for a description of TTB error mechanism. An error condition due to TTB protection will be set.
The parameter TTB Maximum Teperature as been inserted to customize the threshold temperature. For application where metal pipes are used it is usually 120°. For application where plastic pipes are used it be reduced down to 90°.
TTB trip point maximum value is default value of parameter TTB Maximum temperature.

FAULT 8 = Flame circuit error - during normal operation of the ignition controller, flame circuit is regularly checked. This check has predictable behavior and several steps. If check fails, error 8 will be set. When the error is resolved, error will disappear.

FAULT 21 = A/D error

FAULT 25 = Software CRC Matching error.

FAULT 32 = DHW sensor out of normal operating range (short circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again. If ever DHW sensor is faulty, the boiler can enter CH mode anyway, and the sensor error will be displayed.

FAULT 33 = DHW sensor out of normal operating range (open circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again. If ever DHW sensor is faulty, the boiler can enter CH mode anyway, and the sensor error will be displayed.

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Update declaration of conformity	MarCan	0098381	27-Feb-2013	C
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First release – from S4966V2029 rev B	MarPas	0060030	100107	A

FAULT 34 = Low Mains voltage will trigger this error (157V ±10V). When Mains voltage brought back, error is resolved.

FAULT 37 = In case of sensor or water pressure switch - low water pressure, error is triggered. After being brought back to nominal value, error is resolved (see paragraph 6.16 for more details).

FAULT 41 = Water pressure signal timeout. The water pressure value is not refreshed often enough. Possibly caused by communication problems.

FAULT 45 = TTB sensor out of normal operating range (short circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again.

FAULT 46 = TTB sensor out of normal operating range (open circuit) - resolving type. If NTC sensor goes outside the range, warning will be generated. In case sensor is back to the normal operating range, warning is gone. Warning will switch off the system. Heat demands will be disabled. Resolving situation can be achieved only if the sensor is within operating range again.

FAULT 47 = Water Pressure Sensor not connected or broken condition will generate an error.

FAULT 74 = Solar sensor out of normal operating range (short circuit) - resolving type.

FAULT 75 = Solar sensor out of normal operating range (open circuit) - resolving type.

FAULT 76 = Gas Pressure Error – If the Gas Pressure Switch is configured and the Gas pressure Switch opens at any time for more than 5s, Error 76 is generated and will switch off the system. Resolving situation can be achieved only if the Gas Pressure Switch closes again.

FAULT 77 = Siphon input error

FAULT 81 = Drift test Warning (only warning) – refer to Appendix A for further information

All errors are saved in error history and correlated to the number of hours of operation. Error codes 10-22 will not be visible (part of the safety core).

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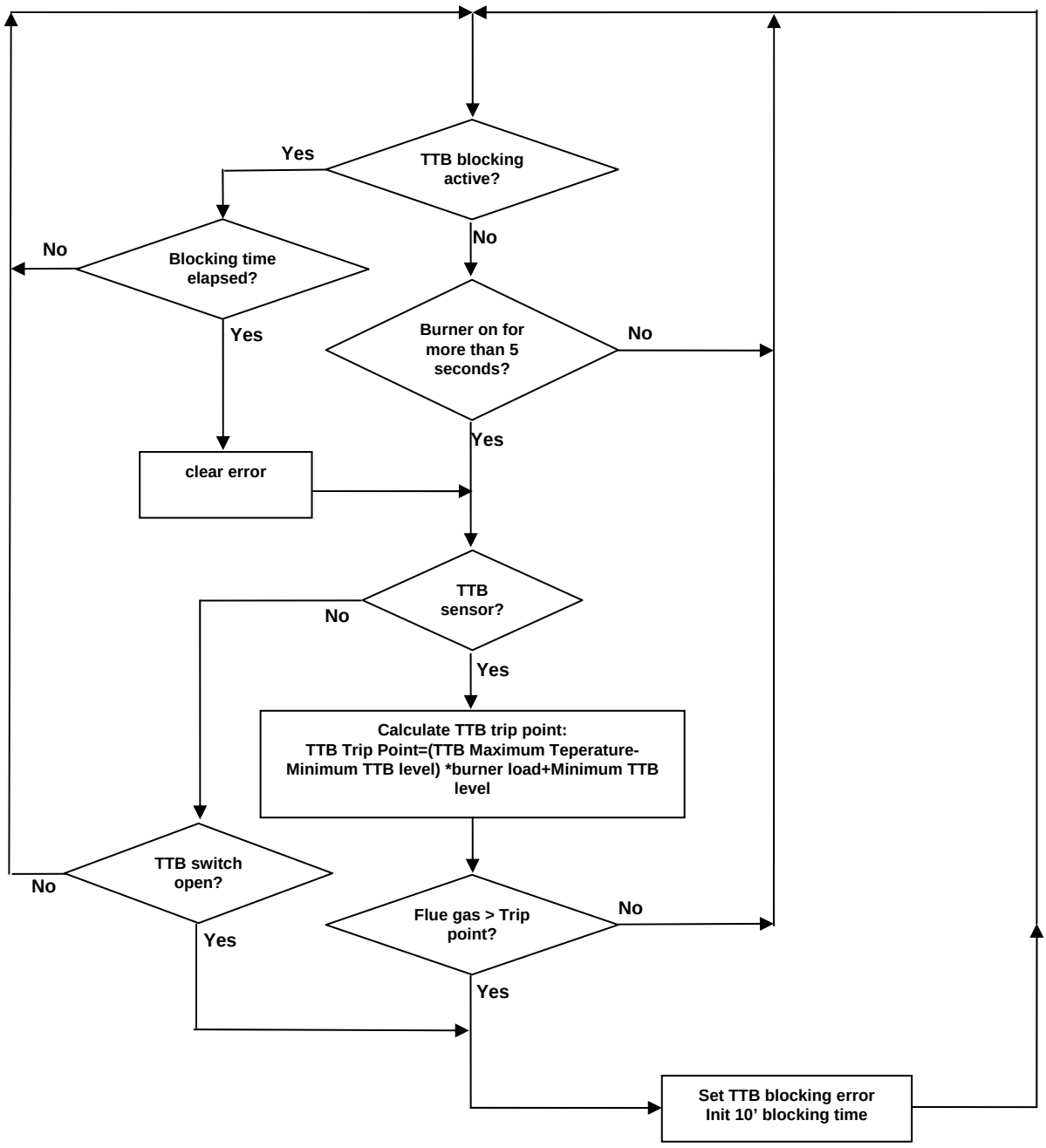

Figure 4 - TTB protection

If Cool Down Time = 0 → TTB Lockout error
If Cool Down Time not zero -> TTB blocking error and disappears after blocking time if resolved, otherwise remains in blocking error.

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6.14 - Ignition sequence

In case of valid heat demand request, ignition sequence will be started. In case of failed ignition, controller will try to re-ignite for number of times. If no successful ignition after programmed number of retrials, flame lockout error will be indicated.

6.15 - Simple User Interface

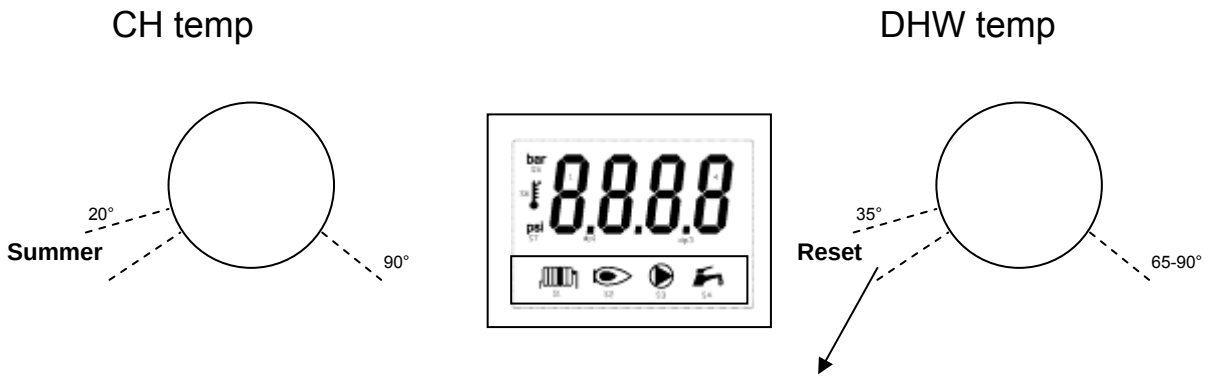
The maXsys Simple User Interface is composed by a custom LCD with 27 segments and 2 trimmers.
The LCD provides two different areas. The biggest area on the top is the window displaying main information related to the operation mode currently selected. The smallest area on the bottom is the status window displaying the active state of CH, DHW cycles, flame presence and pump activation.

NOTE: temperatures will be displayed as CELSIUS temperatures, pressures will be displayed as BAR values.

The Backlight is ON when one of following conditions is met:

1- When acting on Simple User Interface trimmers.
2- During an heat demand (CH or DHW),
3- When an alarm is active
4- At startup

After the condition 1 is finished, the Backlight will remain ON for 5 minutes. (In the other cases only 10s)
When the alarm is active still present, the backlight will be blinking.



Reset position when:
- coming from DHW area and controller in lockout state

Notes:
- Summer mode angle arch is around 16°
- Resolution of CH temperature angle is 254° angle / 70° of CH temp range

Notes:
- **Resolution 254° angle / 30° of DHW temp range (or 55° depending on Max DHW setpoint parameter)**
- **Reset mode angle arch is around 16°**
- **when controller is in lockout state, RESET is gained rotating trimmer from DHW temp arch to Reset Mode arch angle**

6.15.1 - Startup phase

Description	Ope.	ECO	Date	Rev.
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During the startup phase the following information are displayed at interval of 2 sec:

Hup	-> Platform firmware
A.AA	-> Platform firmware level
Lup	-> Custom firmware
B.BB	-> Custom firmware level
EE	-> EEprom data
C.CC	-> EEprom data level
'bar'+ D.D	-> Water Pressure (in bar)

After start up phase, for a period of 5 minutes, only the water pressure is shown. After that will be alternatively prompted the CH temperature for 10 seconds and the actual pressure (if pressure sensor) for 4 seconds. In case of LOP conditions, instead, the LOP symbol will be prompted for 10 seconds and actual pressure value for 4 seconds. In the 5 minutes heat demands are possible.
It is possible to exit the function during the 5 minutes moving the trimmer to Reset position.

6.15.2 - Stand By State

During standby state the simple MMI shows the actual CH supply temperature value along with the thermometer symbol.
In this state the user can modify the values for the CH and DHW setpoint respectively trough the CH and DHW trimmers.
During the setpoint modification phase the backlight is turned ON and the corresponding CH radiator or DHW tap symbol are activated and setpoint value is blinking. When blinking ends, the new setpoint is stored in EEPROM.
Setpoint adjustment is not allowed if a master device (OT or EBV) is connected. On the contrary when Control Panel or Microcom tool are connected, trimmers values are master.
DHW max setpoint is always limited by "Max DHW setpoint for Extended range" (see Parameter list).
The status of pump activation is eventually also displayed in the bottom side of the LCD.
In this state the user can also enter the Special Function Menu as described hereafter in document.

6.15.3 - CH/DHW running State

During the CH/DHW cycles the simple MMI shows respectively the CH or the DHW sensors temperature along with the thermometer symbol. Also the corresponding CH radiator or DHW tap symbol are displayed.
The status of flame presence and pump activation is also displayed in the bottom side of the LCD.
During the running state you can still modify in "real time" the CH/DHW setpoint setting by moving the corresponding trimmers (this is not allowed if a master device is connected OT or EBV)*.

* if summer mode is selected by SimpleMMI and a master device (OT or EBV) is connected, the boiler will remain in summer mode only if this mode is set on the master device.

6.15.4 - Error State

In case of generic error occurrence the corresponding error code will be displayed and the LCD backlight and CH pump are turned on.
In stand-by menu page the error code is shown with an 'E' prefix blinking at 1 Hz frequency (except for low pressure error – see paragraph 6.16), in all menu pages the backlight is blinking to request attention.

Error state can be exit operating the RESET on the Simple User Interface. (or disappear automatically, if it's a self-resolving alarm). RESET is gained, when in error mode, rotating trimmer from DHW temp arch (middle position) down to Reset Mode arch angle position (for at least 3s).

6.15.5 – Special Function Menu

Through Special Function Menu it is possible to check the status of controller and communication, set up parameters, run Test mode, and visualize error codes history.
Special Function Menu is activated trough the following sequence:

- DHW trimmer placed at Reset position and then back to non reset position
- CH trimmer moved to max position and then to min position within 5 sec.

When entered, moving CH trimmer from max to min position, the following menu will be prompted:

1. Info -> Info Mode
2. err -> Error Mode
3. test -> Test Mode
4. para -> Parameter Mode
5. Com -> Communication Mode

To ENTER the selected menu choice, move DHW trimmer to Reset position and back.
Similar to RESET command, in special function pages, we have two different uses, based on the release time:

- more than 3 seconds is a BACK PAGE request
- else (a fast release, for example 1 second) is an ENTER

Pump and flame symbols are always visualized also when acting in Special Function Menu.
Exiting the Special Function Menu (from any position) can be done in one of two ways:

- wait 5 min. without selections on trimmers.
- Go to upper level (until out of Special Function menu) keeping DHW trimmer in Reset position at least for 5 sec. (and release).

Note that in both cases, as far as we are back to StandBy mode from Special Function menu, trimmers will act as CH and DHW setpoint trimmers, so current position will be taken as new setpoint set !

6.15.5.1 – Info Mode

Info Mode menu is aimed to visualize actual values of some fields.
When Info Mode is entered, moving CH trimmer from min to max position, the following menu will be prompted:

1. temp -> temperature values (°C)
2. Stpp -> Stepper motor position (%)
3. fan -> Fan speed (RPM)
4. Ion -> Ionization current (uA)
5. Pr -> water pressure (Bar)

With no movements on CH trimmer, the field name (e.g. ‘Stpp’) and the value (e.g. ‘50’ – meaning 50%) will be showed (no blinking– only ‘temp’ will blink) alternatively every 3 sec: requesting a new field using CH trimmer, immediately stops the running refresh, and shows the new field name.

Menu 1. (temp) selection is done keeping CH trimmer in the menu position for 5 sec.
After selection, the temperature value displayed depends on DHW trimmer position. Moving DHW trimmer from min to max position, the following temperatures will be prompted:

t1 – CH supply sensor temperature
t2 – CH return sensor temperature
t3 – DHW sensor temperature
t4 – OTC sensor temperature
t5 – Flue sensor temperature
t6 – calculated CH supply sensor temperature

Every temperature is shown in the following way: the field name (e.g. ‘t1’) and the value (e.g. ‘65’ – meaning 65°C) will be showed (no blinking) alternatively every 3 sec.

6.15.5.2 - Error Mode

Error Mode menu is aimed to visualize a history log of last errors happened in the control board.
When Error Mode is entered, moving CH trimmer from min to max position, the following menu will be prompted:

1. E1 -> last error
2. E2 -> before the last error
3. E3 -> last before the last error

the field name (e.g. ‘E1’) and the error code (e.g. ‘30’ – meaning error code 30 = CH sensor error short) will be showed (no blinking) alternatively every 3 sec.

6.15.4.3 - Test Mode

Test Mode menu is aimed to drive Test Mode function on CH or DHW modalities.

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The selection can be done (once entered in test mode) with the CH trimmer: first half degrees is CH, the others DHW.; the radiator or the Tap symbols will be consequently prompted on LCD

Required power capacity can be adjusted moving DHW trimmer from min (0%) to max (100%) position.
When the selected test mode is executed "tXXX" and “YYYY” will be alternately displayed on the simple MMI LCD ("XXX" is the required power capacity and “YYYY” is the corresponding fan speed in rpm).

If an external test mode demand is coming from microcom, CH/DHW trimmers will be disabled and setting from microcom will be used.

6.15.4.4 – Parameter Mode

Parameter Mode menu is aimed to let user change parameter values accessible by menu.
When parameter Mode is entered, moving CH trimmer from min to max position, the following menu will be prompted:

1. P01 -> OTC Curve
2. P02 -> OTC Offset
3. P03 -> CH Minimum Load (also copied to DHW Minimum Load)
4. P04 -> CH maximum Load
5. P05 -> DHW Storage Offset
6. P06 -> Enable Priority mgt
7. P07 -> CH Maximum Setpoint

Selection is done moving CH trimmer to the menu position for at least 3 sec.
When parameter selection is done the parameter value is displayed alternatively along with the parameter number.
In this condition moving the DHW trimmer you can adjust the selected parameter value trough all its definition range.
In order to save the modified parameter value into the EEprom area you should wait for the saving stabilization time (5 sec).
In this time frame period you should not perform any other adjustment until the parameter value start to blink. A fast blinking will define that new value is saved.
If you do not want the system to save the modified value of a selected parameter you should move the CH trimmer before the saving stabilization time in order to select a different parameter.

6.15.4.5 – Communication Mode

Communication Mode menu is aimed to visualize the actual status of communication between the control board and clip-in adapter; and between clip-in adapter and an external controller (e.g. EBV controller).
When Communication Mode is entered, the visualized frame of LCD segments will define the status of communication channels as for below attached picture:

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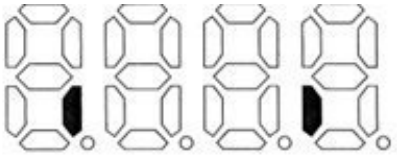
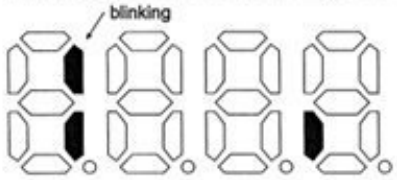


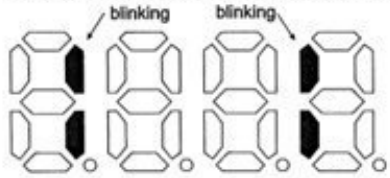
No communication.

If there is only communication between maXsys and RMCI, the following is shown:



Only communication between maXsys and RMCI.

If there is communication between maXsys and RMCI and between RMCI and external controller, the following is shown:



Communication between maXsys and ext. controller.

6.15.6 - Automatic detection of DHW sensor/switch and Water pressure sensor/switch

If the Boiler is configured as Storage (bit0=1 of DHW Configuration), at the start up the system executes the automatic detection if the DHW potmeter is in the Reset position.
When automatic detection starts, the DHW sensor/switch and Water pressure sensor/switch selection are done.
In this situation, when “Set” will be visualized on the SimpleMMI, by moving DHW potmeter out of reset position, the following bit will be configured:

- Bit 6 of the DHW Configuration (Storage Type) is configured according to the type of DHW input. If sensor is present, the bit6 will be set to 0 (Storage standard). If switch is present, bit6 will be set to 1 (Storage Thermostated).
- Bit 2 of System Configuration (WP sensor/switch) is configured according to the type of water pressure input. If sensor is present, the Bit 2 will be set to 1 (WP Sensor). If switch is present, bit 2 will be set to 0 (WP Switch).

6.16 - Water Pressure Sensor

If water pressure sensor is configured, the controller continuously monitors the water pressure and if this value becomes less than ‘Minimum Water Pressure’ + 0.3 bar, a warning message is shown by Simple MMI (‘LOP’) without blocking the burner till the pressure reaches ‘Minimum Water Pressure’ + 0.5 bar.
When pressure becomes less than ‘Minimum Water Pressure’, a blocking message is shown by Simple MMI (‘LOP’ and ‘E37’ alternately in case of pressure switch; actual pressure value and ‘E37’ alternately in case of pressure sensor) and the controller blocks the burner and sets the VJ stepper in the middle position (for water refilling) till the pressure reaches ‘Minimum Water Pressure’ + 0.5 bar (see the following figure).
EBV message for water pressure status (bit5 and bit6) is continuously updated.

Water pressure sensor/switch can be automatically detected (see chapter 6.15.7).

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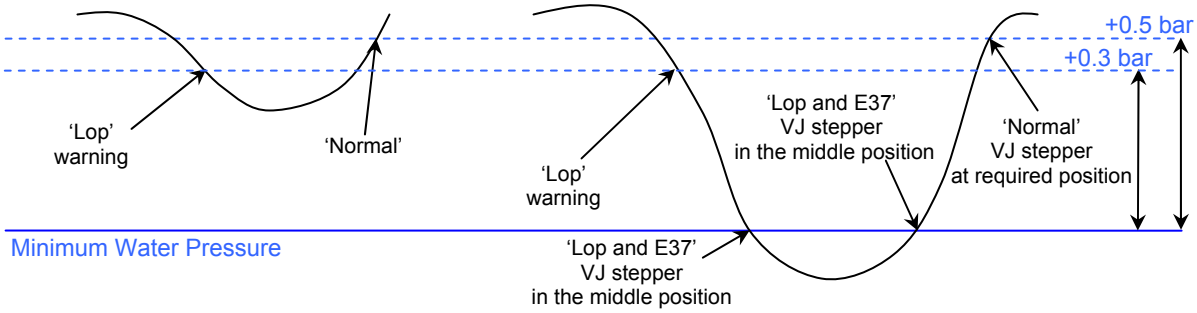

Figure 6 - water pressure error management

6.17 - VJ Stepper management

The VJ stepper position follows the boiler mode of operation (CH and DHW position).
Moreover the stepper could be controlled in two different ways:

- **Force Filling** – If this parameter is set to 255 (see System parameter list), the VJ stepper will be moved in the middle position (no matter if a CH or DHW request is being served). When Force Filling is set to 0, VJ stepper will be moved to the default position or to the required position if a heat demand is active.

- **Parallel Mode** – if this parameter is set to 1 (see System parameter list) and both DHW and CH demand are present, the VJ stepper will be moved in the middle position (defined by ManualStepper target parameter). As soon as one of the two demands ends, the VJ stepper will be moved accordingly to the demand still active.
  When Parallel mode is set to 0, VJ stepper will be moved to the default position or to the required position if a heat demand is active.

6.18 – Solar Pump management

Basic solar functionality with solar pump output and solar panel temperature sensor (PT1000).
The current NTC temperature sensor input can be used without the need to change the design with the next PCB releases.

6.19 – Heat exchanger protection – Delta T control

In order to protect the heat exchanger, temperature difference over it has to be constantly monitored. This difference depends on the several factors: how big is the CH installation, what is the water flow through the system, what kind of heat exchanger is applied and for instance what is the burner output at the particular moment of time.
If too high temperature difference exists over the heat exchanger for a longer period of time it can cause unnecessary mechanical stress to the device.

There is a basic difference between the different cycles, CH mode - DHW mode – TEST mode, concerning dynamics of the supervision or protection, as the water quantity involved during the burner operation is significantly different: therefore is the control refresh rate also different.
In case of heat exchanger protection being active, the temperature on the simpleMMI will start blinking. The blinking continues also in standby mode and stops when a new heat request is detected.

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Parameters description

The algorithm is based on the **HE temperature difference**, that is the absolute temperature difference measured with CH supply and CH return sensor.
It is based on the following parameters:

- **Delta T2** - protection temperature level that can cause proportional decrease in modulation level

- **CH Time loop** – interval time for **HE temperature difference** reading/computing, during a CH cycle.
- **DHW Time loop** – the same of above for a DHW cycle
- **TM Time loop** – the same of above for a TETMODE cycle

- **CH Virtual set point_decrease step** - step used to decrease the virtual set point
- **CH Virtual set point_decrease time** - Time period for adjusting the virtual set point

- **DHW Virtual set point_decrease time1** - Time period 1 to dec. the virtual set point
- **DHW Virtual set point_decrease time2** - Time period 2 to dec. the virtual set point
- **DHW Virtual set point_increase time** - Time period to inc. the virtual set point

- **TM Virtual power_decrease step** - step used to decrease the virtual power
- **TM Virtual power_decrease time1** - Time period 1 to dec. the virtual power
- **TM Virtual power_decrease time2** - Time period 2 to dec. the virtual power
- **TM Virtual power_increase time** - Time period to inc. the virtual set point

Delta T control during CH mode

CH mode with slope function running

If HE temperature difference **< =Delta T2 -3°C**, modulation output is **not influenced**; it is completely supervised by PID control. The Virtual set point calculation will be increase by the **Slope parameter** (see Parameter list).
If HE temperature difference is **>Delta T2 -3°C and <= Delta T2**, the Slope will be set to 2°C/minutes; the Virtual set point will be increase **1°C every 30 seconds**.
If HE temperature difference **>Delta T2 but <= Delta T2 +2°C**, the protection will be indicated on the simple MMI and the Virtual set point calculation will be stopped.
If HE temperature difference **> Delta T2 +2°C**, proportional **decrease** of modulation level will take care that temperature difference goes back to Delta T2 level. To do that, it is used the Virtual set point that is used as a begin temperature for the CH Slope function (see CH mode description). When HE temperature difference > Delta T2 +2°C, the virtual set point become the set point for the PID modulation. This control loop modulates the fan speed in such a way that the CH supply temperature becomes equal to the Virtual set point. This Virtual set point is decreased (till 10°C) by the value of the parameter **Virtual set point_decrease step** when Virtual set point_decrease time is expired.
This decreasing process continues until HE temperature difference <= Delta T2.

CH mode with slope function ended

If HE temperature difference **>Delta T2**, the protection will be **indicated** on the simple MMI.
(but no change on virtual set point yet)
If HE temperature difference **>Delta T2 +2°C**, proportional decrease of modulation level will take care that temperature difference goes back to Delta T2 level. The virtual set point becomes the set point for the PID modulation. This control loop modulates the fan speed in such a way that the CH supply temperature becomes equal to the Virtual set point. This Virtual set point is decreased (till 10°C) by the value of the parameter **Virtual set point_decrease step** when Virtual set point_decrease time is expired. This decreasing process continues until HE temperature difference <= Delta T2.
When HE temperature difference **<= Delta T2**, the simple MMI will finish to indicate the protection and the Virtual set point will be **increased** again with a **fixed Slope of 2°C/minutes**; the Virtual set point will be increase 1°C every 30 seconds.
When HE temperature difference **< =Delta T2 –3°C**, The Virtual set point calculation will be increase by the **Slope parameter** (see Parameter list).

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Delta T control during DHW mode

In case of DHW mode, water quantity is much smaller and temperature changes are much faster to observe: DHW Time loop will usually be lower than CH Time loop, resulting in a faster computing of "HE temperature difference ".
Flow in the DHW circuit is fixed and protection is activated only if Delta T2 level is exceeded.

The Primary set point for PID modulation will be always based on DHW Virtual primary set point: the control loop modulates the fan speed in such a way that the DHW temperature (if storage configuration, CH supply temperature) becomes equal to the DHW Virtual primary set point, in this way:
Start burner for instantaneous:
DHW sensor temperature < DHW Virtual primary set point
Stop burner for instantaneous:
DHW sensor temperature > DHW Virtual primary set point + DHW Hysteresis
Start burner for storage:
CH sensor temperature < DHW Virtual primary set point
Stop burner for storage:
CH sensor temperature > DHW Virtual primary set point + DHW Hysteresis + TempAdder
If the burner will switch off, the DHW Virtual primary set point decreasing is stopped.

Depending from "HE temperature difference":

- **> Delta T2** the protection will be indicated on the simple MMI.
  The DHW Virtual primary set point is **decreased** (till 10°C) 1°C every time that DHW Virtual set point_decrease time1/2 (see Parameter list) is expired. (2 if >= Delta T2+2)
- **> Delta T2 –3°C and <= Delta T2**, the DHW Virtual primary set point is **increased 1°C** until the DHW setpoint (if storage configuration, +TempAdder) every time that DHW Virtual set point_increase time (see Parameter list) is expired.
- **<= Delta T2 –3°C**, the DHW Virtual primary set point is equal to the **DHW setpoint** (if storage configuration, +TempAdder).

Delta T control during TEST mode

(In a standalone boiler it's for TestMode but, it's the real mode used for **cascading**).
The TM time loop parameter can be used to adapt to different cascade "answer time"…

The consequently algorithm depends from "HE temperature difference":

- **> Delta T2**, the protection will be indicated on the simple MMI, and power is **decreased** (till 0) by the value of the parameter **TM Virtual power decrease step** every time that TM Virtual power decrease time 1 / 2 (2 if >= Delta T2+2) is expired.
- **> Delta T2 –3°C and <= Delta T2**, the power is **increased 1** (of 255) until the one requested, every time the TM Virtual power_increase time is expired.
- **<= Delta T2 –3°C**, the power used is the one **requested**.

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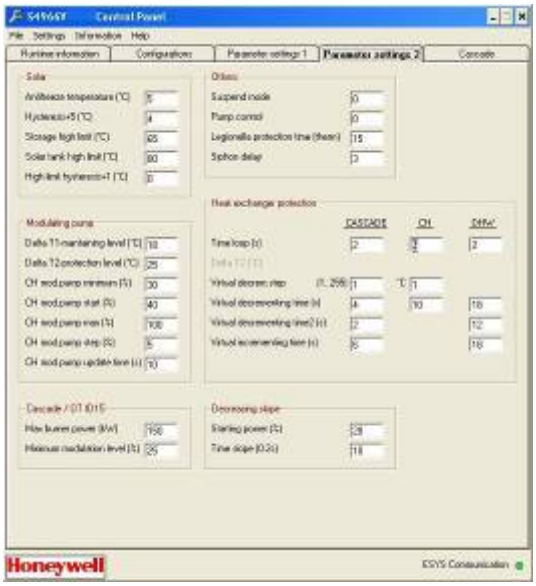
7 - Control Panel for maXsys

A Control Panel for maXsys can be developed to obtain different parameters configurations of the control board.
In the following picture the default settings are shown:



8 - History information

The controller board has a possibility to register fault codes and to write some additional history information in non-volatile memory:

1. Error codes (buffer of the 8 last errors). Every error code has it's time information (coupled with total hours).
2. Total number of burner switching (successfully finished burner sequence with flame on)
3. Total number of lockouts
4. Number of burner "on" hours
5. Total number of hours with power supply on

The history information can be accessed via external communication by using the CVI3 communication protocol.

9 – Installation

9.1 - General remarks

- After installation, ensure total protection equal to at least IP40 level as specified in EN60730-1.
- A high environment temperature affects the operational life of the product. Fit the board in a position with minimum environmental temperature and expose to as little radiation as possible.
- The board does not contain repairable parts. Repair affects device safety and is not permitted.
- The connected devices must display appropriate electrical properties for the loads controlled by the board.

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- If an automatic reset safety thermostat is connected in line with the gas valve operators, the reset timer of this device must be greater than the time taken by the burner control to perform a new ignition attempt. This is to ensure that a non-volatile lockout does not take place if the thermostat cuts-in.
- In the event of shutdown with a consequent situation of non-volatile lockout of the burner control, wait at least five seconds before resetting the system.
- To ensure reliable long term operation, mount the boiler control at a position in the appliance with a low ambient temperature and a low radiation.
- The boiler control should be externally fused.
- High temperatures will affect product life.

NOTE 1: When first starting the boiler control has a self check time of about 10 seconds.

NOTE 2: Electrical rating of connected controls should be appropriate for the load that is switched by the boiler control.

NOTE 3: Disconnect the boiler control from mains before performing a dielectric strength test.

NOTE 4: When first starting, the control can be in the lockout condition; reset the boiler control.

NOTE 5: The flame connection pin of all types is **not** protected against electrical shock.

NOTE 6: An automatic return high limit thermostat can be used. Gold contacts for high limit thermostat are required.

NOTE 7: Remote reset function may only be used in applications where a maximum of five resets per 15 minutes is allowed.

WARNING

Honeywell is not responsible for damage and/or injury due to mis-wiring.
After installation boiler control can become wet due to condensation. **Do not connect wet device to mains.**

9.2 - Electrical connection

- The device must always be connected with the power turned off.
- The device must be connected in accordance with current legislation.
- The device manufacturer's instructions (for boiler, etc.) must always be followed.
- Check that the type, times and code are always as specified before installing or replacing the device.
- Ensure that the combustion chamber is free of gas before turning on the device.
- Ensure effective connection between the device earth terminal, the metal burner case and the electrical equipment protective earth.
- Carry out a complete final check when the installation is complete.
- Electric Protection: Class II

WARNING

- Take care that installer is a trained experienced service person.
- Disconnect power supply to prevent electrical shock and/or equipment damage.

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IMPORTANT

- Wiring must be in accordance with local regulations.
- The appliance manufacturer's instructions should always be followed when provided. If such instructions are not provided see the connection diagrams for typical systems.
- Before installing or replacing any control check that type number is correct for the application.
- Ensure combustion chamber is free of gas before start up.
- Conduct a thorough check out when installation is completed.
- At the first start the boiler control can be in lock-out; depress reset button to free control.

CAUTION

Do not connect the boiler control to power supply when it is not connected to the gas control.

Wiring

- Use lead wire which can withstand at least 105°C ambient.
- Use lead wire which is proven against moisture.
- Wiring between boiler control and spark sensing probe should have good quality insulation, suitable for the temperatures encountered.
- Gas valve should be connected to protective earth.

Spark gap

- Max. allowable spark gap 3.5 mm (recommended 3 mm.)

9.3 - Cables and wirings

- Respect maximum connection cables length requirements.
- Use connection cables with appropriate insulation, working temperatures and moisture resistance.
- Plan separate routes for cables that connect loads at low voltage (SELV) and loads at mains voltage (HT). Avoid connecting high and low voltage cables together.
- The ignition cable must be laid so that it is separate from all the other connection cables. Use short connections to minimize the emission of electromagnetic interference.
- The flame sensor/ignition output is not protected against the danger of electric shocks. The connection cable and flame sensor must both be protected against direct contact.
- Do not use multiple cables to connect more than one external device using a single cable. The use of a multiple cable to attach several external devices supplied with high and low voltage is expressly prohibited.
- The flame control earth terminal and/or the earth lead of the second spark generator output must be connected to the metal earth of the burner by the shortest route and the path must be different from that followed by the other wiring.

9.4 - Ionization current check

- The current value must be greater than the specified minimum.
- If the ionization current is too low, check that the electrode is fully immersed in the flame and that the burner and the flame control are properly connected to the protection earth.

9.5 - Adjustments and final checkout

WARNING
Adjustments must be made by qualified persons only.
If the appliance manufacturer supplies checkout and/ or service and maintenance instructions carefully follow them.
If these instructions are not provided then use the procedure outlined below.

Checking flame current

- The minimum value should be in accordance with specified value.
- To check flame current connect a DC micro Amperemeter between flame sensing wire and flame sensing rod. Short micro-Amperemeter during ignition to prevent damage of the micro-Amperemeter in single rod applications.
- Meter connections polluted with e.g. alkaline substances lying close to earth can cause flame current simulation. Make sure no false flame current can flow from meter connections to earth.
- As in normal operation the flame current is measured during 50% of the time, the read out value is half of the real value. The read out value has to be multiplied by 2 to get the real value.
- If flame current is insufficient check that the flame sensing rod is fully enveloped by the flame and that the burner and the boiler control are reliable grounded.

Final checkout

After installation and any adjustment start the appliance and observe a complete cycle to ensure that all burner components function correctly.

Maintenance and service

The designed lifetime* of this product is 10 years, based on date code, according to
a) the standard EN 298
b) the table on designed lifetime as stated on the Afecor website http://www.afecor.org/

We cannot assume that the product can be safely used beyond the mentioned designed lifetime.

This lifetime is based on use of the control according manufacturer's instructions.
Regular inspection of the control by authorized personnel in accordance with guidelines of the appliance manufacturer is required.

After reaching the designed lifetime the product has to be replaced by authorized personnel.

Note: * Warranty as opposed to designed lifetime is described in the delivery terms.

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9.6 – EMC guidelines

- The position of the ignition cable has to be determined for lowest emission. In general conduct ignition cable along metal pipes or shield metal for lowest loop area
- Do not lead ignition cable close to other cabling.
- To suppress Radio Frequency Interference (RFI) the boiler control including spark ignition cable should be mounted in sufficient shielded environment.
- High frequency radiated emission can be reduced by a 1K spark ignition plug.
- Do not lead flame cable close to other cabling.
- Do not lead DC fan commutation cable close to other cabling.
- Keep high voltage spark wire at least 10 cm. away from other wires.

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Appendix A

- SUPPLY RETURN SENSORS USED AS HIGH LIMIT -

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Temperature Control Function – Description

These functionalities will require a specific application verification to avoid false indication since it is application dependent.

High limit function is realised with two separate sensors positioned at the supply and return of a central heating boiler.
During operation the supply and return sensor are checked on their value.
If one of the sensors reaches the overheat cut-out temperature the controller switches immediately off with a non volatile lockout (**E03**).
This overheat cut-out temperature will be fixed programmed in the ROM of the microcontroller and cannot be changed by the OEM or end user.
In case the value must be flexible (parameter), this value must be maximized by a fixed ROM value.
The typical value for this maximum temperature will be 105 degrees.

As it is not allowed to rely on a single sensor from a safety point of view, the return sensor is used to do some reference measurements. Moreover some dynamic checks are done.
A number of failure modes are considered. For each mode it is described how the failure is detected.

The timings, delays and values, have to be determined based on the characteristics of the boiler.
These items have to be described in detail in the product handbook with the remark that they are safety critical.
If necessary dedicated appliance tests, to determine the correct implementation on the boiler, have to be identified.
Moreover temperature sensors have tolerances. Therefore although the real temperatures of the supply and return sensor are equal, a deviation can be measured.
There is a relation between the maximum deviation (5°C) and the absolute maximum allowed boiler temperature (110°C): The maximum boiler cut out temperature is equal to the difference between these 2 values (105°C).

Drift of sensor

With the use of type 2 sensors (described in EN60730-1), long term drift does not need to be considered.
Nevertheless a drift test has to be done because of determining micro cracks in the sensor.
It is assumed that during a heat demand water circulation takes place.
During standby water circulation is not guaranteed.

Description:
During standby the difference dT between supply and return sensor is measured continuously.
During a time t_sub (5 sec.) dT must be within a maximum of dT_max (5K).
Moreover dT may not change more than Tch_max (3K) during the time t_sub.

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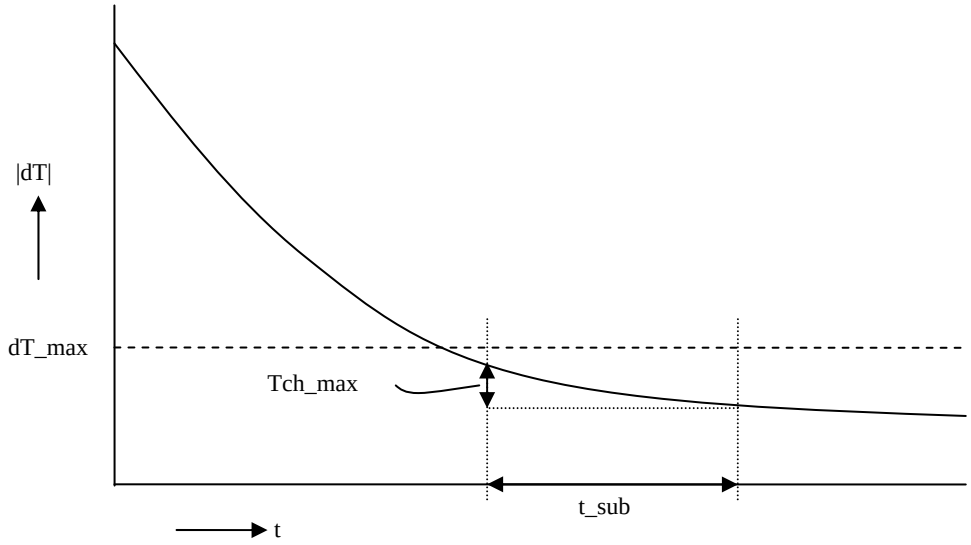

If this test will not pass during standby within 24 hours then the following test has to be done:

Check dT continuously after an heat demand was generated but before opening of the gas valve.
During a time t_sub (5 sec.) dT must be within a maximum of dT_max (5K).
Moreover dT may not change more than Tch_max (3K) during the time t_sub.
If after a certain time (maximum 24hours) the test did not pass, a non volatile lockout will follow (**E15**).
During that time (drift waiting), a volatile lockout error code, to explain why the burner does not ignite (can be for 24 hours), is set (**F81**).

Sensor stuck_at

The sensor output is an analog voltage and is measured with an AD converter.
Into the noise of the AD converter is included: Quantization, gain, offset, supply and temperature influences.
1AD bit corresponds to 0.25°C @ 40°C.
Sensor stuck_at means sensor gives a more or less constant temperature value most likely due to bad thermal contact of the sensor. This is valid for as well the supply as the return sensor.

Supply sensor stuck_at check

After every burner ignition, sensor must change of +/- 0.25°C in 2 minutes (**Supply Sensor Timeout**).
If such a temperature variation is not seen within the predefined time a non volatile lockout error is generated (**E16**).

Return Sensor stuck_at check:

Test A
Within 24hours the measured value must change of +/- 0.25°C.
If this test fails following additional test B will be performed.

Test B
Continuous test is running in background, the controller checks the variation after the next burner start-up to ensure sensors is not stuck at a fixed value.
After the burner has started, there is a time of 240 minutes (**Return Sensor Timeout**) in which the measured value must change of +/- 0.25°C.

Incase both *Test A* and *Test B* fail, control goes in to a non volatile lockout condition (**E17**).

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Incase *Test A* or *Test B* pass, then control will continue to operate.

Cracked sensor

Two types of cracks are considered: large cracks and micro cracks.
A large crack test is not mandatory but is implemented.
Cracks in general at NTC resistors will lead to higher impedance at a given temperature.
Without precaution this will lead to a higher boiler temperature.

Large cracks will be detected by a continuously dTsens/dt test for both sensors.
If dTsens/dt > a certain value (30K/s) than non volatile lockout will follow (**E18**).
Tsens is the absolute temperature of either the supply or the return sensor.
Micro cracks will be detected by the drift test as described above.

Swap Test

To ensure Supply and Return sensors are properly placed a so called swap test is performed
At every burner ignition, after a short timeout (10 seconds) temperature of the 2 sensors is measured. If return temperature is higher than supply +3°C a timer is started (ie 180 seconds). If during this time return temperature remain higher then supply, when time elapses a lockout error is generated (**E80**).

Sensor open or short

Failure detection:
A sensor open or short is detected when a constant temperature value is measured, which is outdoor the standard temperature range.
A failure leads to non volatile lockout.

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Temperature Control Function – Appliance validation

Test to be performed on appliance

Settings for the parameters **Supply Sensor Timeout** OR **Return Sensor Timeout** shall be verified on the appliance by means of tests, as described below, in order to determine the possible negative impact on safety under extreme conditions.

Aim of the first test is the simulation of extreme conditions that could lead to a dangerous situation to verify that above timings will not have impact on safety of boiler.
For this reason is mainly focused on supply sensor being the critical one in such a condition.
More in details test purpose is:

- Find out what happens to maximum temperatures (within the boiler) if supply sensor stuck_at after ignition and before the default timeout time has expired.
- Ensure maximum temperatures, seen on appliance under indicated test condition, will remain below maximum high limit temperatures as declared by boiler manufacturer.
  This means that default timeout does not create safety critical situation. Otherwise in case high limit temperatures are reached, need to shorten default flow sensor timeout to reduce temperature value.

Aim of second test is to verify that no false indications are provided in case temperature sensors need long time to change their value due to critical application
More in details purpose is:

- Find out the maximum time needed to see a variation under worst case conditions (ie big installation with high thermal mass)
- Ensure no stuck_at error will be indicated in case sensors are working but timeout is not enough to indicate their variation (need for longer timeout)

Test execution: FIRST TEST (suggested example)

The following test is an example on how to determine possible negative impact on safety when the appliance is starting up under worst case conditions and a stuck_at situation on the supply sensor. The test method shall be carried out as detailed below. Deviations of the test procedure may lead to incorrect results and possible hazardous situations in practise. In order to get the worst case conditions other settings for the appliance may be necessary

- Ensure no errors are present in the boiler
- Ensure boiler is brought at hot maximum working temperature (ie flow = 80°C – return = 60°C)
- Replace Supply sensor by a potentiometer
- Reduce Supply temperature with the potentiometer in order the burner starts
- Ignite the boiler with no load (or any worst case condition)
- Measure boiler temperature by an external device (independent on boiler)
- Check maximum temperature reached at the end of timeout timer

TEST IS CONSIDERED PASSED IF NO DANGEROUS TEMPERATURES ARE REACHED (IE 105°).
IN CASE SUCH A TEMPERATURES ARE REACHED NEED TO REDUCE THE DEFAULT TIMER (**Supply Sensor Timeout**) AND RUN THE TEST AGAIN.
NEW VALUE of **Supply Sensor Timeout** MUST BE DECLARED AS THE MAXIMUM TIME ACCEPTABLE BY THAT SPECIFIC BOILER and need to be communicated to Honeywell that will implement this value into that specific boiler software

Description	Ope.	ECO	Date	Rev.
Update declaration of conformity	MarCan	0098381	27-Feb-2013	C
Sw upgrade: new supply/return sensor mng, new Simpler MMI mng, various functional changes on customer request.	MarPas	0089869	120607	B
First release – from S4966V2029 rev B	MarPas	0060030	100107	A

Test execution: SECOND TEST

- Ensure no errors are present in the boiler
- Ensure to simulate worst case application from temperature variation prospective (need to simulate conditions where temperature variation is very limited/minimal, typically return sensor is the most critical in this case)
- Ignite the boiler and monitor both Supply and Return temperatures

TEST IS CONSIDERED PASSED IF ON BOTH TEMPERATURE A VARIATION OF ABOUT 0.25°C IS SEEN.
IN CASE SUCH A VARIATION IS NOT SEEN MEANS THAT APPLICATION REQUIRES AN HIGHER DEFAULT TIMEOUT TIMER.
IDENTIFY THE NEEDED VALUE TO SEE A VARIATION FOR FLOW (**Supply Sensor Timeout**) OR RETURN (**Return Sensor Timeout**) DEPENDING WHICH ONE IS NOT CHANGING AND RUN THE TEST AGAIN.
IN CASE ONE OF THE 2 TIMEOUT IS CHANGED (**Supply Sensor Timeout** OR **Return Sensor Timeout** indicated above) NEED TO REPEAT FIRST TEST TO ENSURE NO DANGEROUS CONDITION ARE CREATED BY NEW TIME VALUES.

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