

# COMAS Electronics

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## Engine Controller System

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### General Description

The system provides a complete solution for engine room control. All necessary functions can be accommodated, but the system is modular: the system can be small, using a single controller with some inputs, or can span the whole ship, with hundredths of inputs, tens of displays and numerous control functions.

Low maintenance system with very easy repair and upgrade.

Modular: no single failure can put the system out.

Easy to repair: module replacement, automatic configuration.

### Devices

#### Controllers

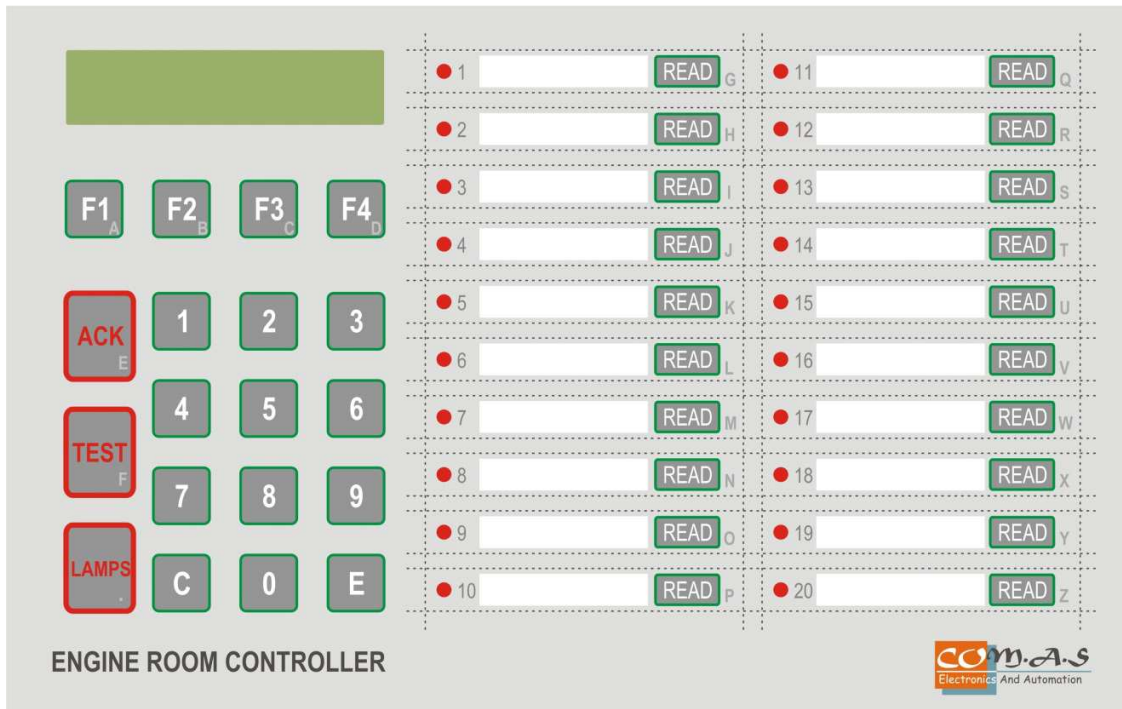
Models:

Basic Controller

Extended Control Device

Ballast Controller

Loading Controller



The controllers can work autonomously or in networks with a main control computer.

Every standard unit has 20 inputs that can be configured as analog or digital (input from contacts). 4 isolated inputs can accept signals from other equipment and can be used as pulse counters or voltage inputs.

Every input has programmable limits.

6 relay outputs: Alarm, Critical Alarm, Malfunction, and 3 programmable outputs that are programmed to be activated from some special input.

2 PID loops provide 4-20 mA analog outputs for control.

User interface:

2x20 display, numeric keypad and function keys. The unit can be programmed from there.

20 input leds with keys that display input status.

3 ways to program the unit: from the keypad and the local display, from the local RS232 port or from the control computer.

Inputs:

The 20 general purpose inputs are dual mode. They can be used either as 4-20mA or 0-10V analog inputs or as digital inputs (contacts or similar). The functions are selected by jumpers. The 4-20 mA inputs detect shorted and cut cables. Digital inputs can be terminated or not. If they are terminated the system can detect cable cut, and with proper connection (dual termination) shorted cables.

Special digital inputs, with optocouplers, are used either as pulse inputs or to connect to voltage, not to a simple switch. Hz and RPM modes are available.

Configuration option: Input type

Type	Fault Detection	Limits	Filter type	
Analog 4-20mA	Detects short and open	Engineering units limit	Analog	
Analog 0-10V	Detects only overvoltage	Engineering units limit	Analog	
Digital simple	no options	No limits, just good/bad level	Timer (counter)	4
Digital with simple termination	open	Fixed limits in analog domain good/bad level	Analog	
Digital with double termination	Short and open	Fixed limits in analog domain good/bad level	Analog	
Pulse counter (frequency)		Integer Limits		

#### Outputs

Relay: Alarm, critical alarm (or high alarm), malfunction, equipment shut down

#### Serial Interfaces

RS485: I/O, network, connection with control computer

RS232: I/O, local setup

NMEA: Output for SVDR

### Interfaces

#### Sensor Amplifiers

Pt100, thermocouple to 4-20mA

Grouped in small boxes (1-5 per box), multi-adder cables to each box

Isolated interfaces for control computers offer protection from engine floor incidents.

### Control Computers

The control computers provide a central overview of the whole system.

They use a control program with very good alarm display, database with all alarms and reporting capability. Graphic user interface for programming the unit. There is possibility for redundant computers with automatic switch-over in case of failure. The units continue to work and provide alarms in case of computer failure.

A special, protected, high reliability Power Supply is used.

## PC PROGRAM

Features list

### System Setup

- Graphic environment for setup
- Computer assisted, safe PID setup
- Device setup save and recall
- On setting change, test and cancel possibility

### Alarm display

- Database of all alarms
- Periodic status save
- Protected data transfer
- Reporting / control PC and external PC

## Displays

## System

## Connections

### Engine Control System

Connections between control computers, interfaces and controllers

### Controllers

Connections to engine floor

### Bridge

Ethernet for display, auxiliary RS485 for backup function

### Auxiliary Displays

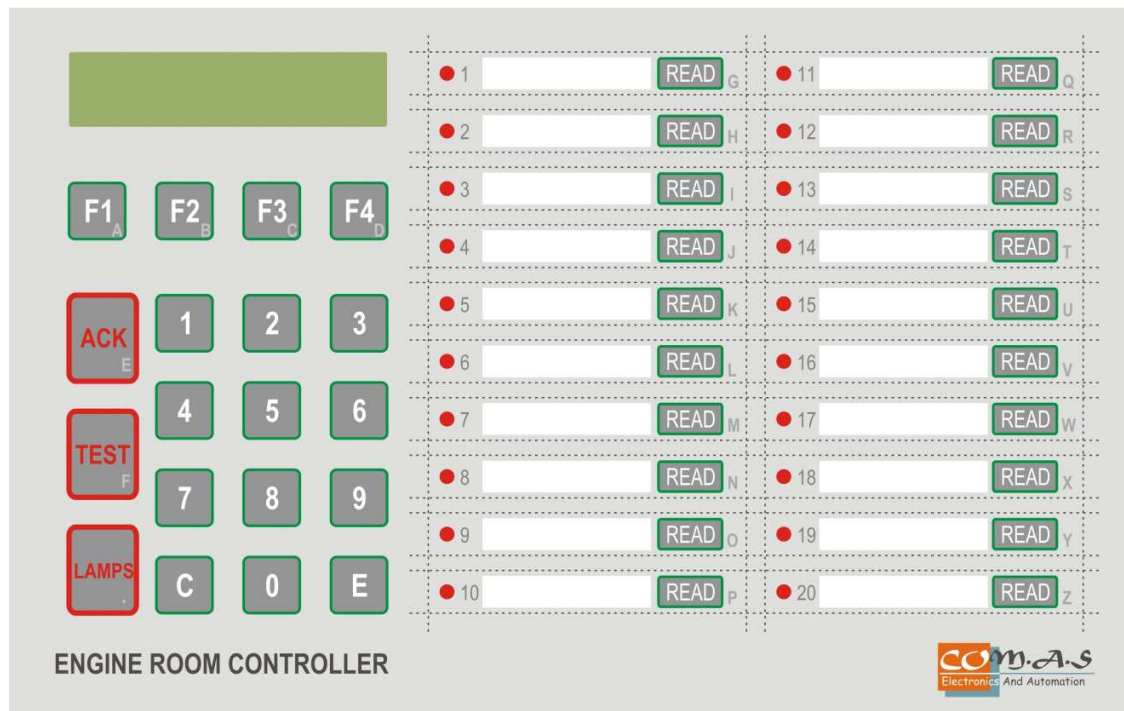
Accommodation ect, not to be used as controllers, WiFi, backbone ethernet

## Functional Description

### Local Function

Alarms  
Control  
Display

Function of the keys of the controller



The standard controller has 39 keys. Most keys are dual function: when setting the controller they are used to enter letters.

Main function

F1-F4: menu selection. The second row of the display shows the function of every key, depending on the state of the system.

Example:

Below are 3 special keys and a numeric keypad with enter and cancel keys.

ACK: alarm acknowledge. If the display shows general alarms, siren shut off. If shows an input, input acknowledge.

TEST: controller self-test

LAMPS: lamp test

C: Cancel

E: Enter, Accept

READ keys: when pressed, the display shows state of relevant input.

## Engine Room and Bridge Control Computers

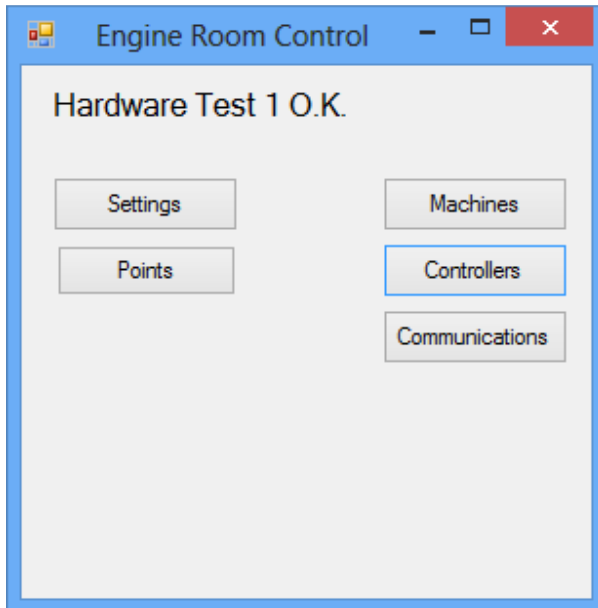
Active control computer gathers data from Engine Controllers, displays and gives data to other computers.

Normally 2 control computers in engine room and one in the bridge.

If active control computer fails, automatic or manual takeover from others.

## Program description

### Main screen



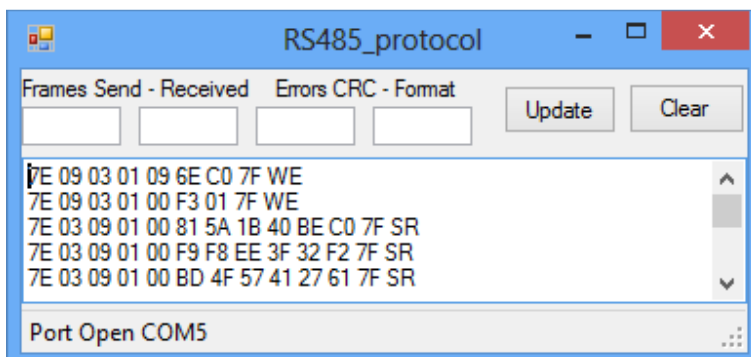
Machines: display status of ships machines (for example, main engine, generators, ...)

Controllers: Display engine controllers

Communications: RS485 data, mainly for test and verification

Settings, points: used for setup, see relevant section

### Communications



## Controller Display

Controller 1: Upper Floor

Address  Active Inputs

### Analog Inputs

No	Name	Reading	Status	High Limit	Low Limit	a
▶ 1	Water Temp	61,92	oC LOW	90	80	6
2	Pressure	2,42	PSI HIGH	2	1,5	1
3	Water Temp	1,86	oC LOW	95	80	1
4	Oil Pressure	13,45	PSI HIGH	3	2	1
5	Exsaust Temp	13,47	oC LOW	200	100	1
6	temp3	-19,99	oC LOW	50	20	6
7	ggii	0,00	kala LOW	4	1	7
		8,51	NORMAL			
		0,01	LOW			

### Digital Inputs

No	Name	Reading	Status
*			

### Outputs

No	Name	Status
▶		
*		

<< >> Send Read Save Close

Pulse Inputs

to be changed!

## Machine display

	Control	Input	Name	Reading	Units	Status	High Limit	Low Limit
▶	1	3	Water Temp	1,86	oC	LOW	95	80
	1	4	Oil Pressure	13,45	PSI	HIGH	3	2
	1	5	Exhaust Temp	13,47	oC	LOW	200	100
*	1	6	temp3	-19,99	oC	LOW	50	20

Ship devices view

## User display

## Accommodation Auxiliary Displays

Tablet like displays in every place where a display is needed. Connection with WiFi. Possibility for smart phone displays.

## Setup

### General Rules

The most significant setup items are the name, function and limits for every input. Every engine controller has its own setup. The setup can be saved and recalled from the control computer. Adjustments can be made either in the controller or in the control computer and can be transmitted to the controller.

In the control computer all settings are in a database file, "EngineRoom.accdb". The database must be consistent: for example, if a machine is described as having 12 inputs, these 12 inputs must exist in the inputs table. Some errors may stop the program from starting, if it cannot handle them. In that case, you must open the database with the auxiliary program "DBViewer" and correct the error before continuing. These errors will not stop the controllers from continuing their operation.



This database file, "EngineRoom.accdb", must be saved and kept as a backup as soon as we get the setup right.

## Controller

Setup menu

Input setups.

Every input point has the following parameters:

Name of Parameter	Data type	Comments
ControllerID	Integer	The ID of the relevant controller
PortNumber	Integer	port number of that I/O type
Type	3 digits	Input/Output, Digital/Analog.... type determines use of limits, see below
Description	text	16 letters name of point
a	Number	Value in engineering units is computed as $ax+b$
b		
Units	text	
ShipDeviceID		Ship device it belongs
Low Limit		
High Limit		
Filter	seconds	Time constant of noise filter
Used	Yes/No	Input can be unused

these setups are the same in the controller and the computer

### Type

Input function is characterized by a 3-digit code.

First digit: Relay to use

0: default relay

Second digit: input function

ALARM 10 normal high-low alarm

CONTROL 20 window control: start on low limit, stop on high limit

CALARM 30 window control with alarm if out of window

Third digit: input/output type

NOT\_PRESENT 0 this input number is not used

IN\_ANALOG 1

IN\_VOLT 2

IN\_DIGITAL 3 analog working as digital

IN\_PULSE 4 with opto - frequency  
 IN\_RPM 5 rpm – rounds per minute  
 OUT\_DAC 6  
 OUT\_PWM 7  
 OUT\_RELAY 8

Examples:

type style 431 => analog in, windows control with alarm, out on 4

011 analog in, simple alarm, use only default alarm relay (0)

311 analog in, alarm, use additionally relay 3

221 analog in, control, out on relay 2, no alarm if out

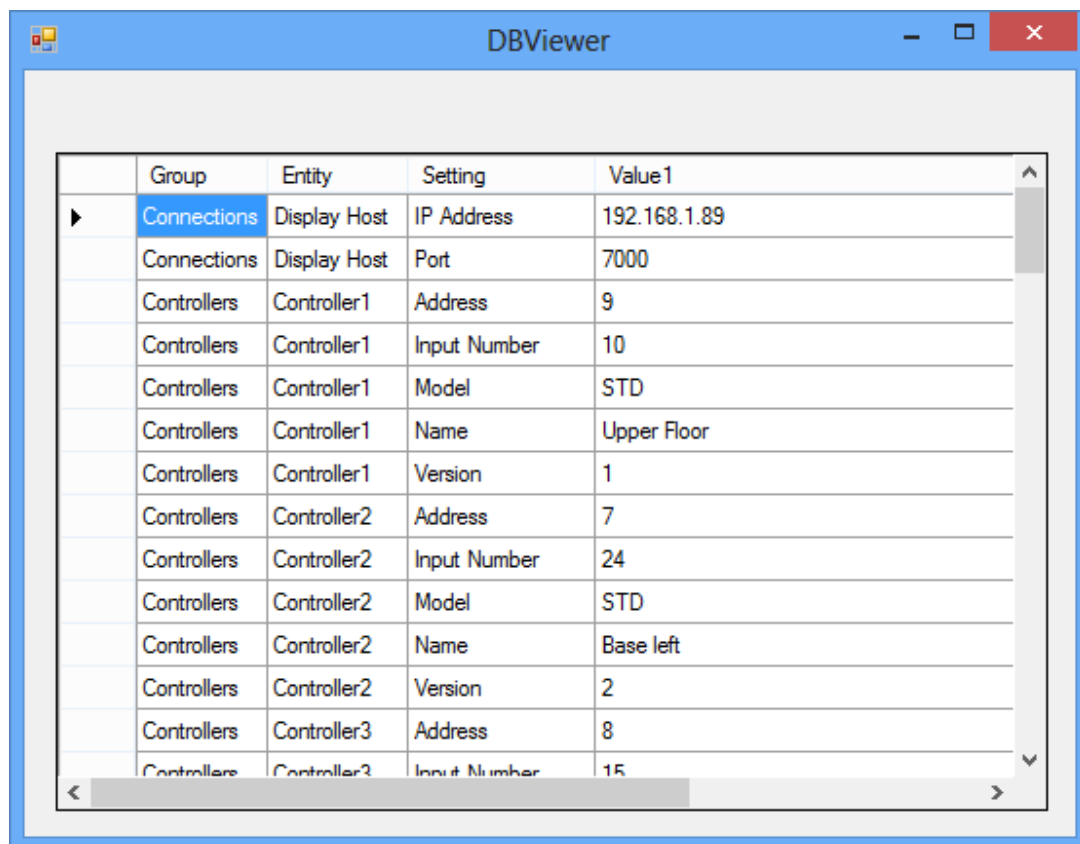
use this if alarms are wider than control, connect second input for alarm

## Engine Room Computers and Interfaces

### Main Setup Functions

The two setup buttons on the main window give full access to the database. All setups can be changed from here, although there are other possibilities, too.

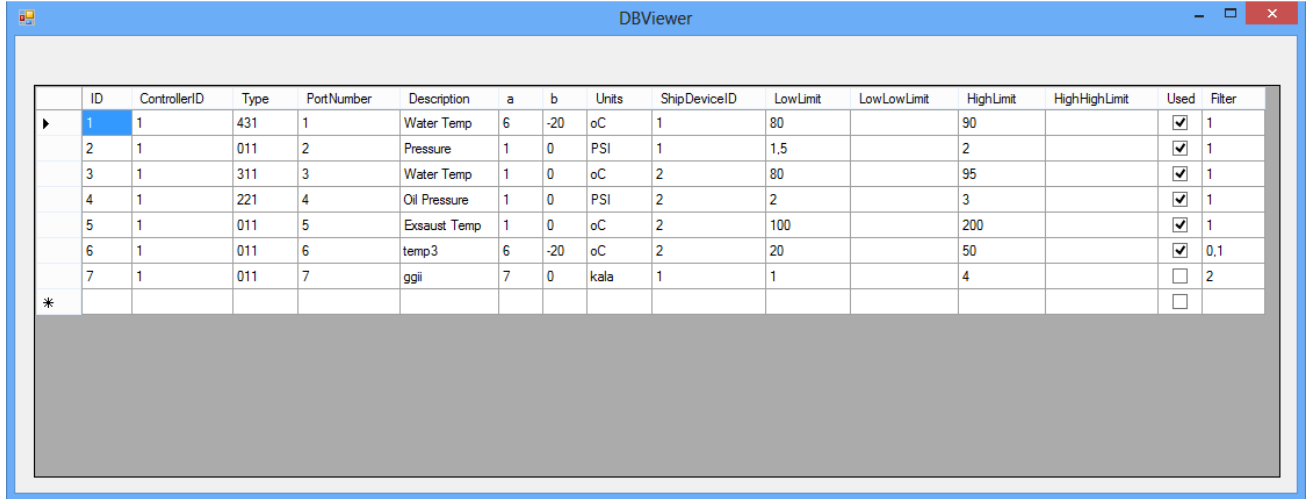
### Setups Button



The screenshot shows a window titled "DBViewer" with a table of database settings. The table has five columns: Group, Entity, Setting, and Value1. The "Connections" group is expanded, showing settings for Display Host (IP Address: 192.168.1.89, Port: 7000). The "Controllers" group is also expanded, showing settings for three controllers (Controller1, Controller2, Controller3) with various settings like Address, Input Number, Model, Name, and Version.

Group	Entity	Setting	Value1
▶ Connections	Display Host	IP Address	192.168.1.89
Connections	Display Host	Port	7000
Controllers	Controller1	Address	9
Controllers	Controller1	Input Number	10
Controllers	Controller1	Model	STD
Controllers	Controller1	Name	Upper Floor
Controllers	Controller1	Version	1
Controllers	Controller2	Address	7
Controllers	Controller2	Input Number	24
Controllers	Controller2	Model	STD
Controllers	Controller2	Name	Base left
Controllers	Controller2	Version	2
Controllers	Controller3	Address	8
Controllers	Controller3	Input Number	15

## Points Button



The screenshot shows a window titled "DBViewer" containing a table with 15 columns and 8 rows. The columns are: ID, ControllerID, Type, PortNumber, Description, a, b, Units, ShipDeviceID, LowLimit, LowLowLimit, HighLimit, HighHighLimit, Used, and Filter. The rows contain data for various sensors, including Water Temp, Pressure, Oil Pressure, Exhaust Temp, temp3, and ggii. The 'Used' column contains checkboxes, and the 'Filter' column contains numerical values. A greyed-out area is visible below the table.

ID	ControllerID	Type	PortNumber	Description	a	b	Units	ShipDeviceID	LowLimit	LowLowLimit	HighLimit	HighHighLimit	Used	Filter
1	1	431	1	Water Temp	6	-20	oC	1	80		90		<input checked="" type="checkbox"/>	1
2	1	011	2	Pressure	1	0	PSI	1	1.5		2		<input checked="" type="checkbox"/>	1
3	1	311	3	Water Temp	1	0	oC	2	80		95		<input checked="" type="checkbox"/>	1
4	1	221	4	Oil Pressure	1	0	PSI	2	2		3		<input checked="" type="checkbox"/>	1
5	1	011	5	Exhaust Temp	1	0	oC	2	100		200		<input checked="" type="checkbox"/>	1
6	1	011	6	temp3	6	-20	oC	2	20		50		<input checked="" type="checkbox"/>	0.1
7	1	011	7	ggii	7	0	kala	1	1		4		<input type="checkbox"/>	2
*													<input type="checkbox"/>	

## Controller Setup

Controller 1: Upper Floor

Address  Active Inputs

### Analog Inputs

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5	Exsaust Temp	13,47	oC LOW	200	100	1
6	temp3	-19,99	oC LOW	50	20	6
7	ggii	0,00	kala LOW	4	1	7
		8,58	NORMAL			
		0,01	LOW			

### Digital Inputs

No	Name	Reading	Status
*			

### Outputs

No	Name	Status
*		

<< >> Send Read Save Close

Pulse Inputs

Send: Send setup from screen to controller

Read: Read Setup from controller

Save: Save Setup to Database

To reload setup from database you must restart the program

## Bridge

## WiFi and Auxiliary Display

## Calibration