Overview

IQAN is a state-of-the-art system, developed by Parker Hannifin, for electronically controlling and monitoring hydraulics in mobile machines. IQAN communicates with the other systems in the machinery, such as diesel engines and transmission systems. IQAN master units display data from these systems and also allows control of them.

IQAN is user-programmable via a high level graphical design tool, which dramatically simplifies development. Simulation of the control system takes place in parallel with the programming of machine functions. The IQAN software tools cover all phases of a machine’s life cycle, from development through productions to after sales.

Custom Programming in House

IQAN’s greatest feature is the ability for any engineer to program the system.
Main IQAN Window Screen Displaying Function Windows

**APPLICATIONS**
Details all functions that are being used on the Main Window Screen.

**TAB BAR**
Featured in a bar on top of the page. It highlights tabs for Inputs/Outputs, Calculations, Miscellaneous, Interface, CAN, and Safety Functions.

**PROPERTY SCREEN**
Shows properties of items highlighted in Main Window Screen.

**MAIN WINDOW**
Screen showing details of highlighted Action of Application Screen. It is also the viewing space for all program links and interlocks.

**LOWER SUB WINDOWS**
These three windows are where the actual Math Function and program interlocks are defined.
APPLICATION WINDOW

This gives definition to the Main Screen and shows all the primary Design and Program groups of the program.

Application, Channels, Modules, Measure Groups, Adjust Groups, Logs, Languages, Display pages, Images, and Security Screens all get defined to some level from a simple default selection to detailed and intricate interlocks.

PROGRAMMING TABS

The function of the tab bars allow for definition of Inputs and Outputs, as well as Math Functions, Function Groups for variables to defined from the screen, and CAN communication for the program interlocks.
DEFINING AN APPLICATION GROUP

To the right, you will see that the Joystick Group has been selected. This allows for Definition of all the Joystick Functions.

MAIN SCREEN

The Main Screen, as it is seen on the right, displays the Function Parameter (FP) Joystick Reduction.

This screen shows the interlocks of the definition of the Inputs with respect to the sensors and the Math Functions which define the Outputs for the machine control.

Listed is the Joystick Functions Screen.
By selecting Machine Diagnostics in the Applications Window, the Main Screen changes to show all the interlocks and definitions of Machine Diagnostics.

Examples include Service timers, Filter status, Joystick status, Loader Hours, and status of all the modules for the system.
Channels Screen and Benefits

CHANNELS SCREEN

In this screen, Design can review all Inputs, Outputs, and every single function defined in the program.

The key advantage of this screen is a quick view of any type of item, such as Digital In, Voltage In, or Frequency In.

Now you can look quickly and review any input into the control system and ensure that the scaling is defined correctly and to your satisfaction.

VIEW OF MAIN SCREEN WHEN CHANNELS OPTION IS SELECTED
The Modules and Application Windows are the most critical for Machine Control function. The module windows is where all control modules for the control system are defined. Any controller for the CAN system is selected and defined in the window including all custom CAN/J1939 modules, such as Engines.
MD3 MASTER CONTROLLER (BLOCK DIAGRAM VIEW)

By selecting the MD3 under the Modules column you will be shown the Block Diagram of the MD3. The key of this main screen is it shows all connection points on the MD3 and what function is occupying the Inputs, Voltage In, Digital In, etc. The grayed boxes show items used or not allowed on the module.

A key advantage to IQAN Design is the ability of every I/O point to be a real name and not defined as in PLC program, such as I01a-b, where it is often unclear as to what this means. In the screen shot below, you see a Boom Lever or P-Brake Release.
This screen shows the XA2-A1 Module Block Diagram. The reason this has a designator of XA2-A1 is that there are two XA2 modules on the system. Each has a unique address to define the difference between the two. A0 and A1 are the designators.

Each module is defined by an address tag in the harness so a replacement module can be generic and be installed into the system as required.

A system can take up to four modules of any type on each CAN bus.
Definition of a CAN-bus Module

Since the Engine communicates its status via CAN J1939 messages broadcast on the bus, the system must be told which messages to receive, monitor, and advise the operator as to their status.

Some of the messages are critical, and some are background messages. All the messages can be defined here and are shown in the image on the right.

Note, that the engine is defined as J1939-B0 which means a generic J1939 unit on BUS B with address 0.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Channel</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGIN-A</td>
<td>EEC #1 (61444)</td>
<td>Engine temperature #1 (ET1)</td>
<td>Electronic engine controller #1</td>
</tr>
<tr>
<td>PGIN-B</td>
<td>Engine Temperature (65262)</td>
<td>Engine temperature #1 (ET1)</td>
<td></td>
</tr>
<tr>
<td>TSCI-A</td>
<td>Engine command (TSCI) (RPM)</td>
<td>Torque/Speed control #1</td>
<td></td>
</tr>
</tbody>
</table>

LIST OF ALL CAN MESSAGES DEFINED FOR THE ENGINE
Measure Groups

MEASURE GROUP DEFINITION

In IQAN Design, the ability to measure Inputs/Outputs, functions, and CAN messages via a real time graph solution can be defined in Measure Groups.

The advantage of Measure Groups as a defined set, is that items of a groups can be viewed together. (Engine, Transmission, Joysticks, etc.)
## Measure Groups

**LIST OF ALL GROUPS DEFINED TO BE MEASURED**

<table>
<thead>
<tr>
<th>Measure groups</th>
<th>Name</th>
<th>Order</th>
<th>Description</th>
<th>Channels</th>
<th>Log</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Engine</td>
<td>0</td>
<td>SAE J1939 Engine diagnostics.</td>
<td>4</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Transmission</td>
<td>1</td>
<td>Transmission I/O diagnostics.</td>
<td>7</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Signal generators</td>
<td>2</td>
<td>Measures signal generators for display page simulation.</td>
<td>5</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Joystick</td>
<td>3</td>
<td>Joystick signals.</td>
<td>3</td>
<td>No</td>
</tr>
</tbody>
</table>

**ENGINE LIST OF ITEMS GRAPHED**

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Status</th>
<th>Raw value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed [rpm]</td>
<td>4681.13</td>
<td>OK</td>
<td>37449</td>
</tr>
<tr>
<td>Coolant temp [°C]</td>
<td>92.00</td>
<td>OK</td>
<td>132</td>
</tr>
<tr>
<td>Command (TSC1) [RPM]</td>
<td>1550</td>
<td>OK</td>
<td>0</td>
</tr>
<tr>
<td>Engine load [%]</td>
<td>0.00</td>
<td>OK</td>
<td>0</td>
</tr>
</tbody>
</table>

**TRANSMISSION LIST OF ITEMS GRAPHED**

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Status</th>
<th>Raw value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward</td>
<td>False</td>
<td>Unknown</td>
<td>1</td>
</tr>
<tr>
<td>Reverse</td>
<td>False</td>
<td>Unknown</td>
<td>0</td>
</tr>
<tr>
<td>P-Brake released</td>
<td>False</td>
<td>Unknown</td>
<td>1</td>
</tr>
<tr>
<td>Safety switch</td>
<td>False</td>
<td>Unknown</td>
<td>1</td>
</tr>
<tr>
<td>Speed pedal [%]</td>
<td>0.00</td>
<td>Unknown</td>
<td>2511</td>
</tr>
<tr>
<td>Pump output [%]</td>
<td>Unknown</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Motor output [%]</td>
<td>Unknown</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Adjust Groups

ADJUST GROUPS

Like Measure Groups, Adjust Groups and grouping of like functions in which parameters of the items can be changed by the operator while operating the machine or a change of performance for the machine during set up.

A good example is modifying the valve output’s Maximum speed by changing maximum current, or changing the ramp up and ramp down times for the main boom cylinder to allow for smoother operation.

TRANSMISSION ADJUST GROUP DETAIL OF FUNCTIONS DEFINED
The Logs group allows you to define all items to Log of events and monitoring for status. A good example is Engine events for Oil Pressure and Engine temperature for over heat.

The Engine issue are critical for machine performance. Logs allow the machine design to monitor and record via a Real Time Clock the status of the machine for performance and Warranty.

All Logs can be defined as to who has access to the Logs. In the Security section the analysis of Logs can be determined.
Languages

IQAN Design Supports most languages on the globe in the program. The key aspect to languages is the machine designer selecting the languages that are preferred for the machine. As shown are English and German.

LANGUAGE DEFINITIONS

- The functional names of the machine must be defined in German by the machine designer
- As IQAN can covert the program phrase but not machine specific terms
- The ability to convert back and forth on the machine
  - To suit a operator or service technician
  - Easily done
Display Configuration

DISPLAY CONFIGURATION

If your system Design Includes a Display/Master controller. Then details of the display are defined at the point. This is a very powerful aspect of Machine design for the Human machine Interface (HMI).

The IQNA program can take almost all forms of pictures, JPEG’s, BMP’s etc. Also, IQAN Design has a very extensive SAE and ISO Library of symbols for configuration as well as dynamic symbols (IBAR and IGAUGE) in gauges, bar graphs, and color coded symbols.

Display pages are defined as types and each pages is laid out for clear definition.

DISPLAY PAGES- EACH PAGE IS DEFINED FOR MACHINE FUNCTION
Display Configuration

MAIN DISPLAY PAGE DETAIL

Explanation and Detail of Layouts and Soft button Functional Definition
SAE Symbols and Library

SAE IMAGE EXAMPLE FROM PULL DOWN LIBRARY IN IQAN DESIGN
SAE Symbols and Library

DISPLAY PAGE OF ENGINE - SHOWING BITMAPS AND VARIABLES

SAE SYMBOL LIBRARY EXAMPLES

- angle_white
- battery
- battery自理
- battery_white
- headlamp
- hydr_failure
- hydr_failure自理
- hydr_oil_level
-自理
Security Groups

Security has several forms in IQAN design...the key and most important issue is to define the Security aspects of the program early in the design, so that the program is configured with the items in mind.

:: Security for access to the program to view and change functional items to machine control

:: Security Definition of what Display Screens can be seen by the operator as he runs the machine

:: Display screens that only a service technician can view as a function of a PIN entered on the display

:: Security of items that can be Accessed in the adjust groups Marine Navigation Systems
IQAN Creative Software Conclusion

Efficiency in focus – throughout the entire machine life cycle.

J1939 – Applications

:: Agriculture
:: Forestry
:: Military Vehicles
:: Fleet Management Systems
:: Marine Navigation Systems
:: Diesel Power-Train Applications
:: In-Vehicle Networks for Trucks and Busses
:: Truck-Trailer Connections
:: Recreational Vehicles
:: And more …

Intelligent Software – Electronic Control Made Easy