

Development of Setup Tools for Inverter

🔊 VET, VEC, Parameter setup, Monitoring, Trace-back, Visual screen

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Abstract

Conventionally, parameter setting and status monitoring are performed through using an inverter panel surface or with operation from a host controller.

Recently, many kinds of visual tools using Personal Computer (PC) screens have been adopted for such operations. These tools are high-functioning because allow not only parameter setting but also monitoring of numerals and waveforms of the inverter status.

Meiden Visual Engineering Tool (VET) and Visual Engineering Creator (VEC) are tools developed with the concept of “providing satisfaction to all customers.” The customers can customize the screen interface to meet their own or the application’s needs.

1. Preface

For a long time, the number of inverters deployed in the world has grown at the average rate of between 5~20% annually. Among most inverters or power converters used to drive motors, the market share of general-purpose inverters accounts for about 90% of the manufactured units or about 65% of all inverter sales. A general-purpose inverter is high-performance due to expanded applications in fields where it is easy to use. For many years, our company has manufactured and delivered general-purpose inverters, keeping up with the requirements of the times. This time, we developed leading-edge inverter setup tools, the Visual Engineering Tool (VET) and the Visual Engineering Creator (VEC), drawing on our rich engineering resources of such software. This paper mainly introduces features of the VET and VEC products.

2. Features of VET and VEC

Fig. 1 shows an example of VET screen and Fig. 2 shows the system configuration of a Meiden inverter. The data exchange of parameter info, etc. is done through serial communications between the Meiden inverter and a Personal Computer (PC). Using the exchanged info, the VET provides the following functionality for the user.

- (1) Parameter management function
- (2) Monitoring function
- (3) Trace-back display function
- (4) Event-logging and reference function

In addition, the VET provides other functions as specified below.

- (5) Visual screen function

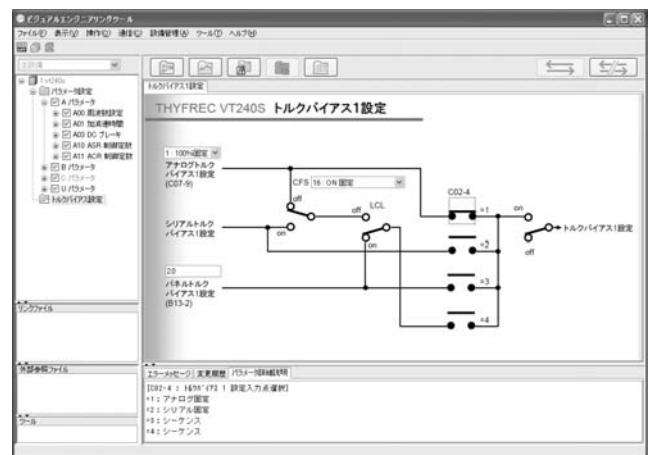


Fig. 1 Example of VET Screen

With the VET, parameter control and monitoring can be shown on the PC screen.

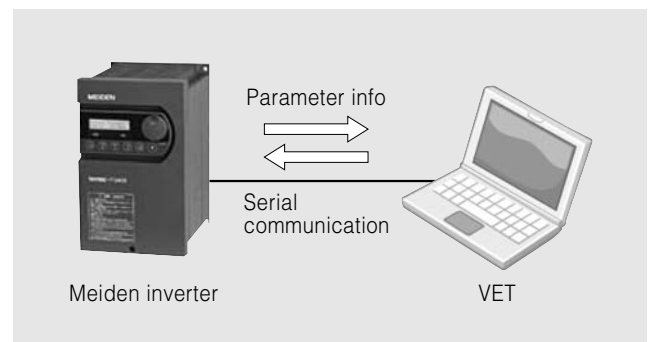


Fig. 2 System Configuration

The system configuration of the VET and Meiden inverter is shown.

The visual screen function offers features for graphical parameter setting and status monitoring. If a visual screen is edited by tool VEC, the visual screen layout

Table 1 Basic Specifications

Basic specifications of the VET and the VEC are shown.

Item	Contents
Applicable models	THYFREC VT240S THYFREC VT240EL THYFREC VT710S/VT710P THYFREC VT800 THYFREC VT330DY
No. of connectable units	32 units Max. (according to models)
Applicable language	Japanese, English, and Chinese
Communication system	Meiden standard serial (ASCII)

Table 2 Hardware Requirement

The VET and the VEC can be used in the following PC environment.

Item	Contents
PC	PC/AT DOS/V compatible machine
CPU	Pentium M 900MHz or above
Memory	512MB or higher
HDD vacancy capacity	100MB or higher
Screen definition	XGA monitor (1024 × 768) or higher
Keyboard/Mouse	Indispensable

can be freely customized according to the user's needs. Therefore, easy-to-use visual screens can be provided to all customers. The capability of visual screen production is the key feature of this tool. Table 1 shows the basic specifications of this tool, and Table 2 shows its hardware requirements. A maximum of 32 inverter units can be connected, applicable to English and Chinese in addition to Japanese. The operating platform is Windows OS.

3. VET Functions

3.1 Parameter Management Functions

For the efficient control of an inverter, the following functions are available.

(1) Parameter setting

Fig. 3 shows a parameter setting screen. There is a parameter setting column in the list. A numerical input of the parameter is entered with a text box and a selective input is entered with a combo box. The entered parameter is sent from the VET to the inverter and the inverter reflects the received parameter info from the VET. The parameter details can be indicated in the screen.

(2) File preservation and reading.

Parameters can be preserved in text format files. As such, all inverter parameters can be preserved as backup files, or shared among multiple inverters.

(3) Comparison of parameters

Parameter values in the VET are compared with those in online inverters. Upon completion of comparison, parameters having different values will be listed in the VET.

(4) Change History Record function

When the parameter value was changed using

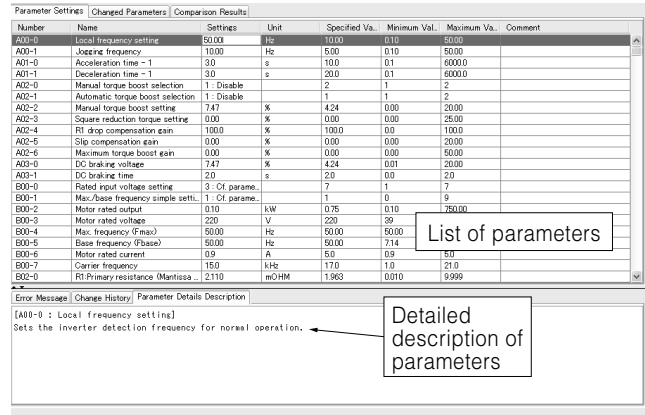


Fig. 3 Parameter Setting Screen

The parameter setting screen for the VET is shown here.

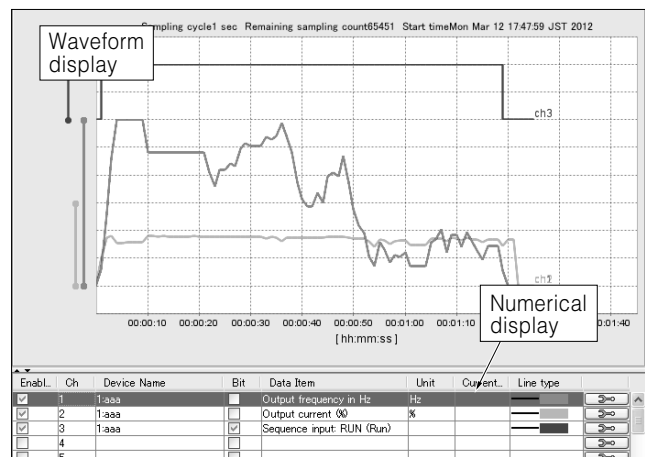


Fig. 4 Monitor Display Screen

Inverter current and voltage values and such monitoring info can be checked by waveforms and numerals on the VET.

VET, it is displayed in a log list with the value before the change.

3.2 Monitor Display Functions

Fig. 4 shows the monitor display screen. The monitor display functions are used to read the monitored parameter data and show the inverter status by numerical data or waveforms. For the effective monitoring of inverter status, the following features are provided:

(1) Trigger function

This function makes it possible to execute a start and end of graphical waveform depiction at any timing. If a pre-trigger function is used, the waveforms before and after the designated phenomenon as a trigger condition can be stored for later analysis.

(2) Cursor function

It is possible to refer to any arbitrary timeframe value on the waveform. If two cursors are used, it is also possible to display a time gap between two cursors.

(3) File preserving and data reading

The sampling data displayed in the monitor screen can be preserved in a file. Once these data are

Latest	Previous time	2 times before	3 times before
Item	Details		Unit
Primary fault cause	020A Automatic tuning abnormal completion Calculation opera...		
Secondary fault cause	0000 -		
Output frequency	0.10		Hz
Output current	0.5		A
DC voltage	284		V
H / W fault signal	0		
Cumulative power ON t.	331		Time
Cumulative running time	7		Time

Fig. 5 Fault Event Record Reference Screen

Fault event factors can be checked on the VET if any inverter fault occurs.

preserved, these data can again be read and analyzed.

3.3 Trace-Back Function

In order to define the possible cause of a fault at the earliest opportunity, Meiden direct-HV inverter THYFREC VT710 Series (VT710 hereafter) is fitted with a function for automatic recording of monitored data before and after the fault occurrence. The function is called the trace-back function. The VET can read the trace-back data saved in the VT710 and can show in the waveform from like the normal monitor display and can do the analysis using the cursor function.

3.4 Fault Event Record and Reference Function

With the Meiden inverters, each monitoring value and the causes are recorded automatically when an accident occurred. The VET can read and display the fault event record data saved in the Meiden inverters. Fig. 5 shows the fault history event record reference screen.

4. Visual Screen

4.1 Features

As described previously, the visual screen is a noteworthy function for this tool. There are two features as shown below.

- (1) Inverter parameters can be graphically set up.
- (2) The screen layout can be flexibly customized by customers as well as the applications.

An illustrative case would be where we input data of motor's acceleration time, deceleration time, and revolving speed.

For conventional tools, as shown in Fig. 6, parameter setting is made based on the parameter list. For this reason, even a few setup parameters have to be picked from a large volume of a parameter list. In addition, this parameter list has character info only. Accordingly, to understand the meaning of each parameter more correctly, one has to read through the inverter instruction manual where explanatory diagrams are involved.

If this example is realized with the visual screen, it becomes Fig. 7. This visual screen is composed of a background picture that contains a parameter name, unit, and explanatory diagram and a setup form used for changing the values. If it was made in a required format, the illustration made by any general image creation software can be used for the background. The

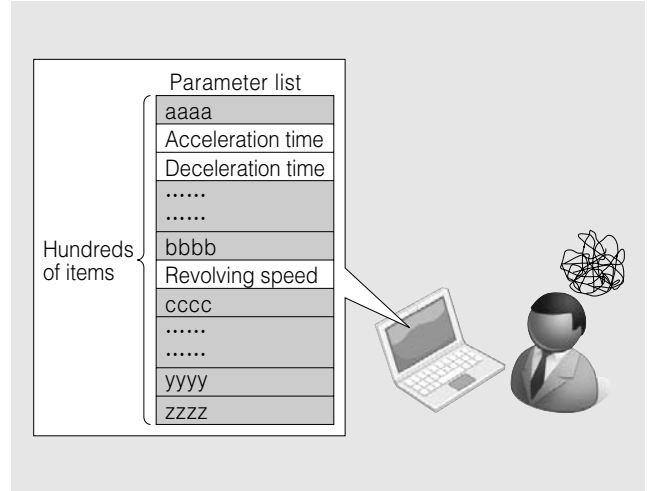


Fig. 6 Parameter Setting with Conventional Tools

In the conventional method, you need to find the needed parameters out of the vast volume of parameters.

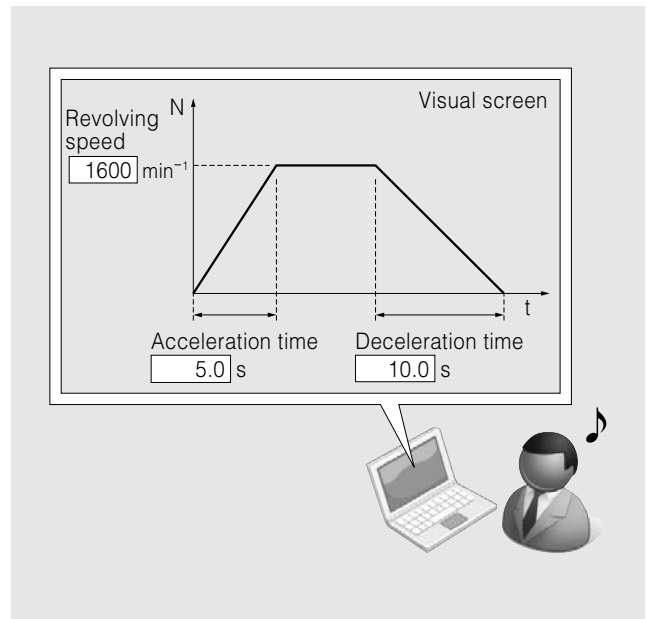


Fig. 7 Parameter Setup with Visual Screen

Ignoring unnecessary parameters, you can set up the parameter with a help of the illustration.

background image can be an illustration produced with an ordinary image creating software, provided that the designated image form is used. In regard to the setup forms, forms for necessary parameter setup items can only be freely allocated in the background image.

The visual screen has solved various problems relating to conventional tools. It offers effective user interfaces meeting the customer's purposes.

4.2 Method for Screen Creation

Visual screens to be operated under the VET are created with the VEC. Fig. 8 shows the VEC screen and Fig. 9 shows the visual screen creating procedures. The visual screen made with the VEC generates a file output to the format that can be used with the VET. The visual screen of the file output is used by reading its data with the VET.



Fig. 8 VEC Screen

The VEC uses images and various formats so that layout can be freely customized according to the customer's requirements and applications.

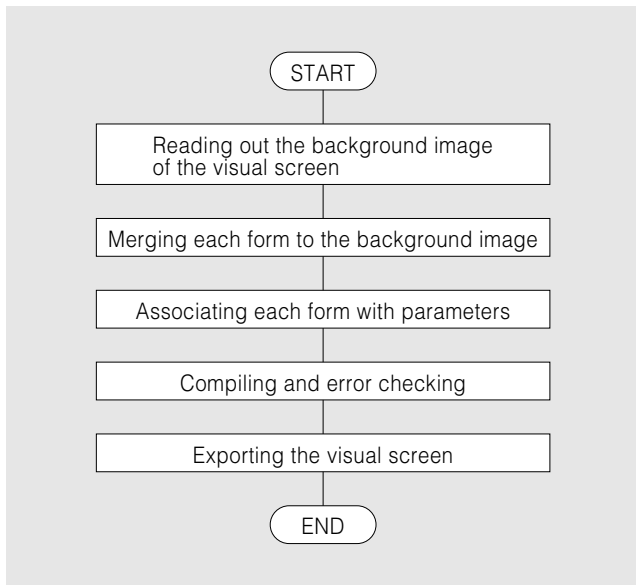


Fig. 9 Visual Screen Making Procedures

Visual screen production procedures with the VEC are shown in a flowchart.

Table 3 Parameter Setup Formats

When these formats are used, sensory setup of numerals and selective parameters becomes possible in a visual screen.

Type		Image
Numerical parameter	Spin button	
	Slide bar	
Selective parameter	Contact	

4.3 Parameter Data Entry Format Types

In addition to ordinary text box format and combo box format, the parameter setup forms to be used in the visual screen come in the types as shown in Table 3. In addition to parameter setup formats, various kinds of other formats and functions are available as shown in

Table 4 Monitor Parameter Display Formats

When these formats are used, you can see monitor parameter values.

Type		Image
Numerical parameter	Label	
	Bar	
Bit parameter	Lamp	
	Check box	<input checked="" type="checkbox"/>
	Button	
	Contact	

Table 5 Other Useful Functions

When these functions are used, visual screens with more diversity can be made.

Type		Image
File link		
Tool link		
Screen link		
Comment button (Comment display with button click)		

Tables 4 and 5. By making use of these formats, it is possible to create more varied visual screens.

4.4 Examples of Visual Screens

4.4.1 Setup Wizard

Fig. 10 shows the setup wizard for inverters. When this wizard is used, it is possible to make inverter setup just as installing a PC application. This wizard is composed of multiple visual screens connected with the "screen link button." This screen is suitable for a customer who is using inverters for the first time.

4.4.2 I/O Sequence Signal Monitor

Fig. 11 shows the I/O sequence signal monitor screen. This monitor screen can confirm the ON/OFF status of inverter's I/O sequence signal together with the signal name, using a single screen. This monitor screen is generated with the sequence signal and the linked "lamps" of display format on top of the background image with the signal name. Each lamp reads the ON/OFF status of the associated signal from the inverter under the specified interval and changes each lamp color according to the status at that time. This monitor screen is very useful during inverter maintenance services.

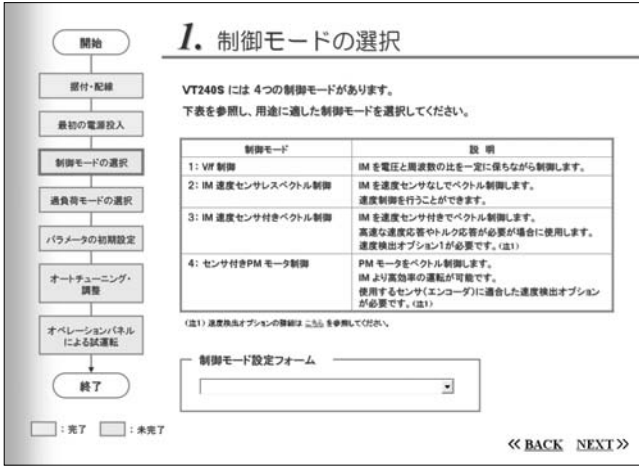


Fig. 10 Setup Wizard
Just like application software installation to a PC, you can setup an inverter.



Fig. 11 Sequence I/O Signal Monitor Screen
You can see the ON/OFF status of inverter I/O sequence signals on the screen.

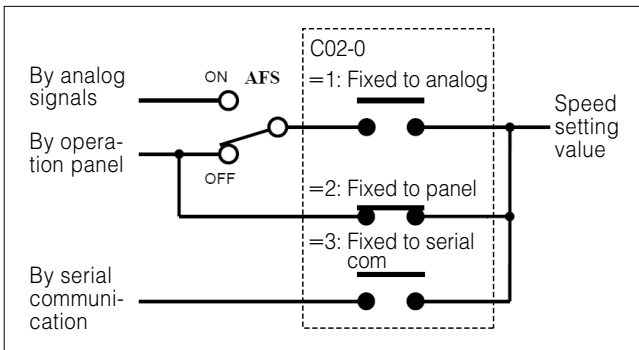


Fig. 12 Speed Setting Method by the Selection Screen
You can easily select the speed setting method at the inverter.

4.4.3 Speed Selection Screen

The revolving speed of an inverter-driven motor can be set up by inputting the commands to inverters by various methods. Fig. 12 shows a screen for easy selection of the speed setup. This selection screen shows the case of parameter setup “contacts” and display “contacts” allocated against the background image of routing lines and characters. The status of

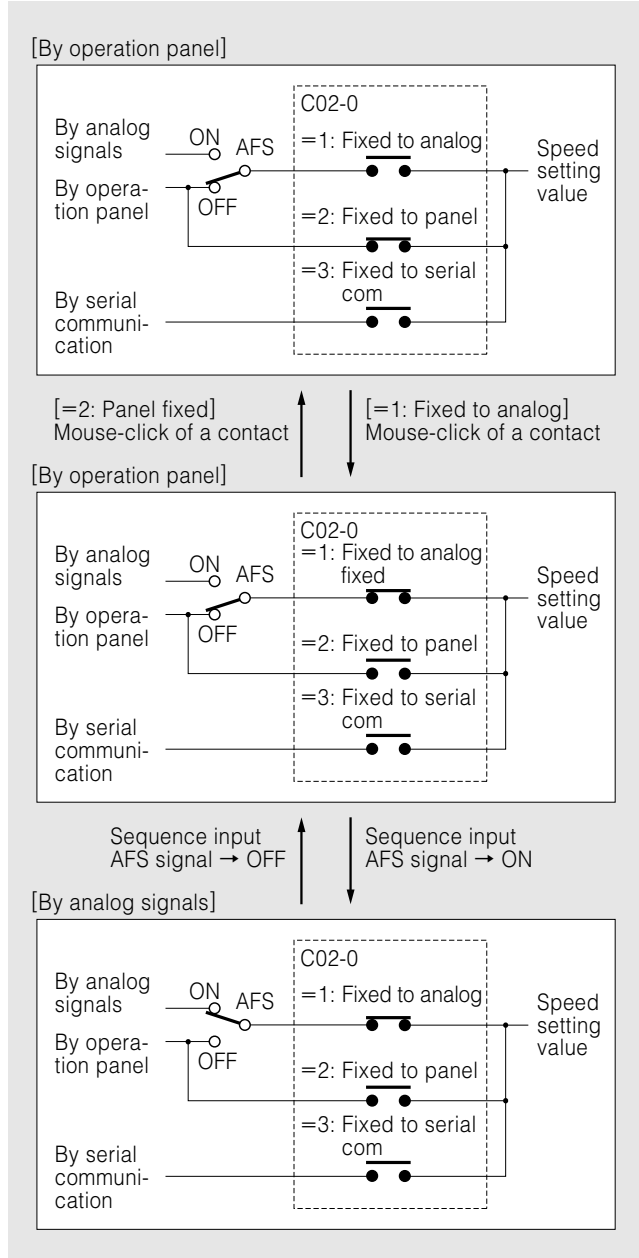


Fig. 13 Change Procedure for Speed Setting Method
Change procedures for the speed setting method are shown above and the status of each contact on the screen.

contacts shown in Fig. 12 indicates that the motor revolving speed can be set up from the operation panel of the inverters. To switch to an analog signal method, it is necessary to take the following actions with the use of this setup screen:

- (1) Changing the setup value of Parameter C02-0 into “1: Fixes analog”

Setup values are changed by clicking on parameter setup “contacts” located in this selection screen. The three contacts are linked to C02-0 Parameters 1~3 as seen from the top. The contact selected by clicking transmits the related value to the inverter where the setup value of Parameter C02-0 is changed. The contact that has confirmed this change turns to an ON state as shown in Fig. 13. The contact in ON state

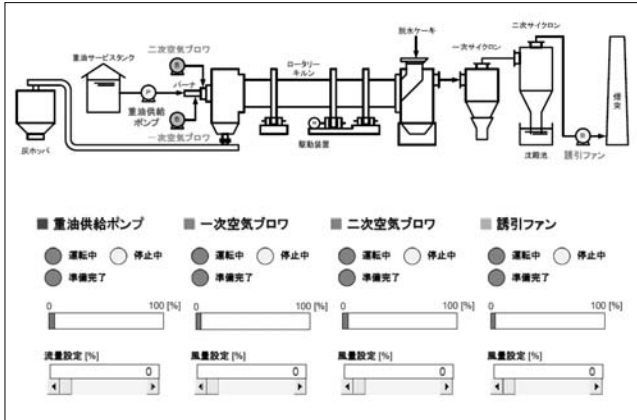


Fig. 14 Example of Customer Facilities Management Screen

A single visual screen makes it possible to manage the Meiden inverters installed in a customer's facility.

before the change turns to an OFF state.

(2) Setting sequence input AFS signal to ON

The display “contacts” allocated in this selection screen are associated with sequence input AFS signals. Like the “lamps” described previously, each “contact” reads the ON/OFF status of the linked signal at the predetermined period so that the contact can be

changed according to the status at that time. The status of an AFS signal given from outside of the inverter can be checked on this selection screen.

4.4.4 Facility Management Screen

The visual screen is also capable of parameter setup and monitoring for multiple inverters in a single screen. Fig. 14 shows an example of a customer facilities management screen where the above-mentioned feature is utilized. When this management screen is used, multiple Meiden inverters installed in facilities can be managed in a single screen. This screen was developed for our customers who have Meiden inverters.

5. Postscript

This paper introduced the outline features of our products VET and VEC, which were developed recently. In regard to the general development trend of the setup tools for PC, we expect its operability and monitoring function will improve in the market. To meet this challenge, we will make our product better in terms of functions and performance.

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