

Various Retrofit Application Technologies

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Abstract

The meaning of “retrofit” is a general term referring to the improvement of functions by skillfully renovating the old products with new products. In other words, it refers to the work to extend a products’ life or a facility which has deteriorated functions due to aging, normal deterioration, or has become “aged” or near the stage of scrapping. It restores lost functions and improves functions by “retrofitting.”

Since existing facilities are reused, cost is far lower than that of introduction of fully new facilities. In addition, retrofitting is also considered environmentally conscious work.

As a result of the development of retrofit application products, it is possible to reduce risks with preventive maintenance and proper management of facility operating costs. In addition, we can offer an extension service of facility life and provide partial updating services.

1 Preface

While many systems installed are now getting old, we face problems such as the discontinuation of major system component or difficulty in acquiring same models or their parts due to design changes. It is, however, possible to keep up with adequate maintenance and management systems if suitable measures are taken against unexpected challenges in major system products, or if proper replacement is periodically performed. Under such circumstances, quality and satisfaction level of maintenance services can be improved by providing the alternative replacement parts in the place of the parts that are difficult to obtain.

This paper introduces our supply service of replacement parts or equipment with our various installed products and how we manage alternative replacement products.

2 Outline of Retrofit Product Development

2.1 Purpose

For systems and facilities that are currently working but no alternative equipment is available in the market due to model design changes or the dis-

continuation of those models, we supply alternative replacement parts or products that can be replaced with minimum labor. It becomes possible to extend the operational life of customer systems and facilities with these aforementioned options.

2.2 Background

Because of the sluggish investment in facilities in Japan, facilities have tended to have been operating for a longer period of time while still being well maintained. System product parts and tools, however, face the discontinuation of production. Extension of facility life is getting more difficult due to the challenge of limited availability of necessary replacement parts. In order to extend the operational life of these facilities, we are supplying equipment, alternative replacement parts, and tools needed for partial renovation. The merits of retrofitting are as follows:

- (1) Since partial renovation is possible, cost for facility renovation is reasonable and lower as compared with full replacement.
- (2) Automation, labor saving, and adding high system performance can be realized, along with technical progress by innovations.
- (3) Familiar facilities can be used as continuously as the renovated updated facilities with improved performance.

(4) Partial renovation can reduce the volume of industrial waste as compared with full replacement. It is useful in terms of reducing the need for recycling and environmental impact.

2.3 Supporting Situation

Table 1 shows the developed retrofit application products.

2.4 Retrofit Application Products

2.4.1 Development and Application of Retrofit Digital Relays

Fig. 1 shows the overcurrent relays manufactured before and after renovation. Production of induction disk type relays is already discontinued and it is difficult to replace them with digital relays in a short amount of time. To meet the renovation needs in a short time frame without disturbing present facility operation, the alternative replacement relays currently available are designed to have favorable characteristics, such as interchangeability in terms of shapes and approximation of characteristic curves. The major features are as follows:

- (1) Alternative replacement relays are applicable to seven major models.
- (2) Thanks to interchangeability in mounting postures, fieldwork can be easily carried out.
- (3) Characteristic curves are similar to those of conventional induction relays.
- (4) By going digital, it has improved performance characteristics, reliability, and maintainability.

2.4.2 Small-Capacity Tele-Controller XTC1100

Fig. 2 shows two models of small-capacity tele-controller units: before retrofitting and after retrofitting. The XTC1100 is an alternative replacement system for the conventional STC1000. The XTC 1100 has a small-scale sequencer (PLC) RC500 with an added function of communication functions equivalent to those of a tele-controller. The major features are as follows:

- (1) Compatibility
Downward compatibility is secured in regard to control, the number of indications, quantity of telemetry, baud rate, etc.
- (2) Common design for item fitting structure of the panel

Table 1 Retrofit Application Products

Retrofit application products supplied in the past and their contents are introduced in the table below.

Theme	~Fiscal 2011	Fiscal 2012	Fiscal 2013~
Proposal of solution to extension of life ↓ (Development of retrofit application products)	Development of substitute for discontinued supply of conventional units and maintenance parts		
	[Products and units] • Replacement mouse-PS/2 for μPORT • Substitute for small-capacity tele-controller (XTC1100, XTC100) • Substitute for SCSI disks • Auto-driver for dynamometers • Substitute for induction relays	Continued investigation into customer needs and development of replacement units to cope with the discontinued production Substitute for MEDIMUL Modification of OS for printer systems Examination and development of substitute for POK-7 Substitute of FD unit for SCSI-II Development of exposure stage reproducer Development of HP robot motor drive tester Substitute power source unit for PLC Development of P6-P4 conversion adapter Improvement of control center tester Development of standard communication applications for Meiden PLC Emergency applications: Development of alternative items, requesting for supports, shortage of parts	Actions taken for shortage issue of parts due to discontinued production
[Power supplies] • Power supply for ADC4000 (PS400) • Reproduction of MVX28B-01/02			
[Loader substitute] • For HD1000, P8000, P2000			
[Conversion tools] • TACSYS HPC→RC500 • P2000→RC500 • One-loop controller FD100			
[Others] • P2-P4, HLD-FD100 conversion adapters • Control center unit tester			

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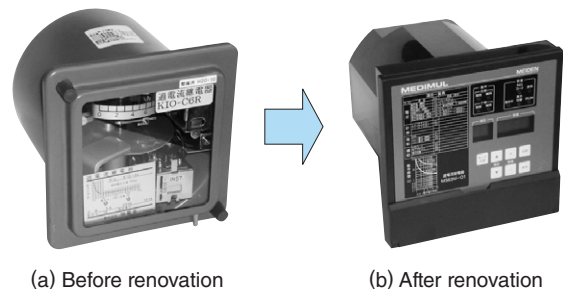


Fig. 1 Overcurrent Relay

Substitutive products using MEDIMUL have been developed.

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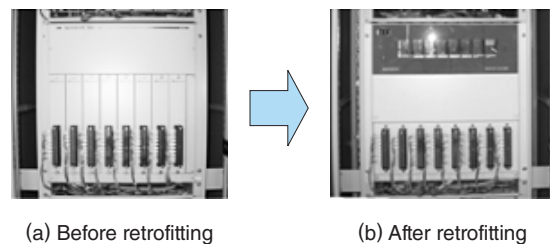


Fig. 2 Small-Capacity Tele-Controller XTC1100

Since panel mounting construction and wiring mode are used in common, working time has been curtailed.

For retrofit work, it does not require the modification of the panel; therefore, time for facility shut-down is reduced.

(3) Common use of cabling mode

Design interchangeability of terminal block is secured. Replacement work of external cables is not required.

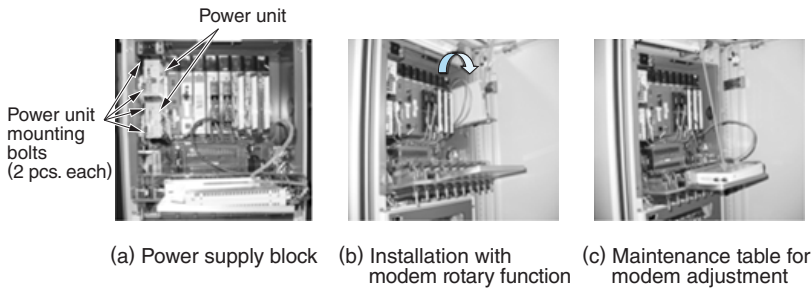


Fig. 3 Improved Maintainability with Front Access Design

Adoption of front access design has improved maintainability.

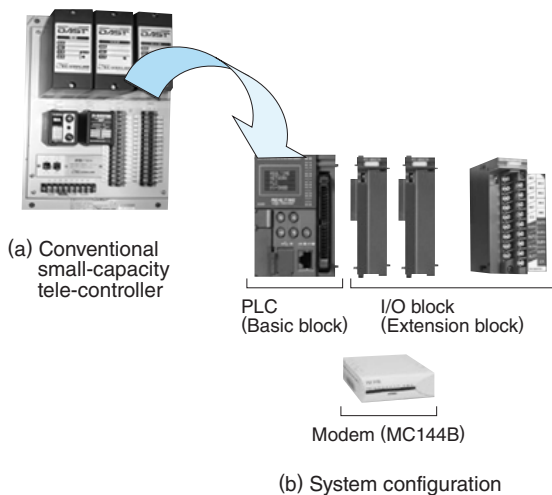
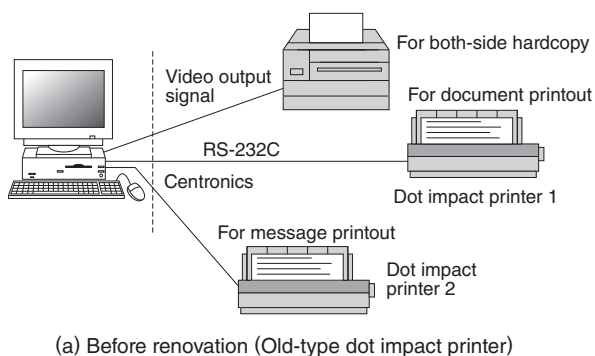
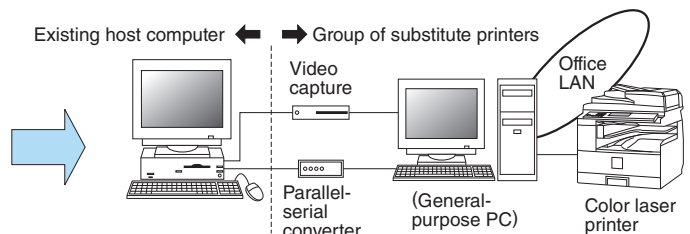


Fig. 4 Small-Capacity Tele-Controller XTC100

These are replacement products with a sequencer of a small-capacity tele-controller and a modem.



(a) Before renovation (Old-type dot impact printer)



(b) After renovation (Substitute printer subsystem)

Fig. 5 Printer Subsystem

The system configuration of printer Subsystem is shown before and after the renovation work.

(4) Improvement of maintainability

Due to the adoption of front access design, maintenance work can be easily carried out (see Fig. 3).

2.4.3 Small-Capacity Tele-Controller XTC100

This is an alternative replacement product of a conventional small-capacity tele-controller. It is composed of the PLC and a modem (MC144B) (see Fig. 4).

2.4.4 Printer Subsystem

The printer subsystem functions as an alternative replacement product for the conventional dot impact type printer whose production has already been discontinued.

Fig. 5 shows the system configuration of a printer subsystem: before replacement and after replacement. The host computer and a Personal Computer (PC) are connected through a serial cable so that the PC can download messages and document data from the host computer.

Message data are displayed on the monitor screen and recorded in the database. Data-logging data are converted to Excel files using a data conversion application.

Messages can be printed out anytime. Even past messages obtained through data retrieval function can be printed out. When the date changes (during the renovation of monitor screen), automatic printout can be made freely. The major features are as follows:

(1) Retrieval function

High speed queries (access by duration, subject equipment, or keyword, etc.) can be made to a database. This function is useful in making statistical reports on error code data.

(2) Format report printout

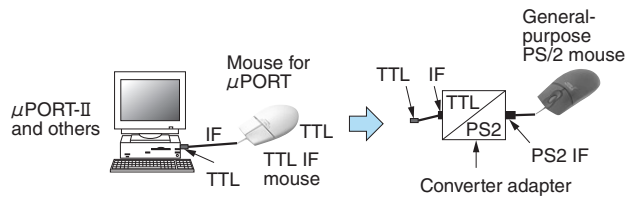
Automatic printout of daily, monthly, and annu-



(a) General-purpose PS2 mouse and its replacing adapter (b) Inside of replacing adapter

Fig. 6 Mouse Converter

An external appearance of the mouse converter is shown.



(a) Conventional configuration (b) Substitute configuration

Fig. 7 Mouse Converter Configuration

Equipment configuration of the mouse converter is shown.

al reports is possible anytime.

(3) Format report data

Report files can be established on the basis of daily, monthly, and yearly report. Such data files are saved on the hard disk.

2.4.5 Mouse Converter

Fig. 6 shows an external appearance of the mouse converter, Fig. 7 shows its configuration, and Table 2 shows the specifications. Since it is now hard to obtain mouse devices for Meiden computer μPORT Series, this converter unit is used so that a mouse (PS2 IF) of the PS/2 specifications used for general purpose PCs can be used as an alternative replacement for μPORT mouse (TTL IF).

2.4.6 Loader

Regarding PLCs delivered in the past, many PLCs are still installed in industrial facilities and most of them are currently working. These products and dedicated loaders (MS-DOS PCs) are difficult to obtain and repair.

Even though there is a proposal for renovation, software that is available cannot be defined and cost for renovation tends to be increased because expenses for additional design work pile up. For this reason, it is generally hard to promote renovation. As such, we have developed the Win32 loader to

Table 2 Mouse Converter Specifications

Specifications of mouse converter are shown.

External size, mass	W70 × H70 × D25mm, 152g
CPU	20MHz, RAM 2KB
Port 1	For μPORT connections
Port 2	For PS/2 mouse connections

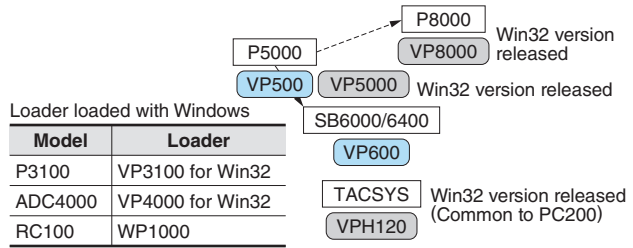


Fig. 8 Systematic Diagram of Loader

This diagram shows past variations in loader products. In order to continue maintenance, applicable loaders are continuously procured.



(a) External appearance (b) Internal wiring

Fig. 9 Multi-Controller

An external appearance and internal wiring are shown for the multi-controller.

realize the replacement. Fig. 8 shows the system diagram of the loader.

2.4.7 Substitute for HSC (Multi-Controller)

Fig. 9 shows an external appearance and internal wiring of the multi-controller. The compatible relay circuits are installed to work with existing facilities (The relay circuits are all different).

2.4.8 Program Converter Tool

This software is intended to convert the programming codes of conventional UNISEQUE P5000 into codes for RC500. It makes it possible to perform alternative replacement operation by RC500. Ladder sequence and system setup data loaded in a conventional TACSYS system are automatically converted into the sequence and data structure of our currently available general-purpose model RC500. Fig. 10 shows the configuration of program converter tools.

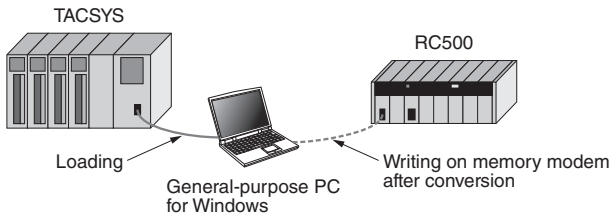
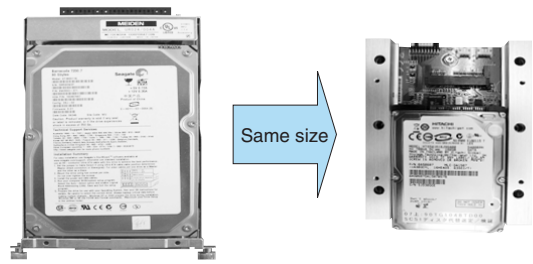


Fig. 10 Configuration of Program Converter Tools

Configuration of program converter tools (conversion of differences in languages) is shown for the programmable controller.



(a) Before retrofitting

(b) After retrofitting

Fig. 12 SCSI Disks Unit

A substitutive product of SCSI disks unit is shown for maintenance.

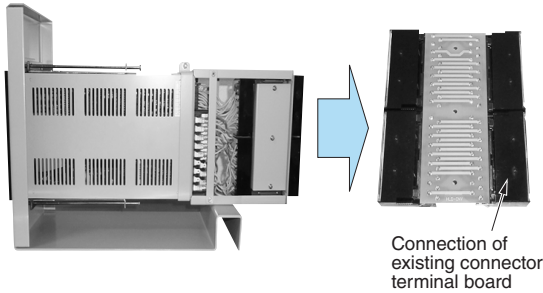


Fig. 11 HLD-FD100 Connector Conversion Adapter

The connector conversion adapter (intended to decrease connection changes in external wiring) is used when the one-loop controller is modified from HLD to FD100.

2.4.9 HLD-FD100 Connector Conversion Adapter

In order to reduce working time and avoid wiring errors at the time of renovation of the HLD of one-loop controller into the FD100, the P2-P4 conversion adapter is used for the replacement of HLD&RIO40 power source (connector type conversion). Fig. 11 shows the HLD-FD100 connector conversion adapter.

2.4.10 Substitute for Small Computer System Interface (SCSI) Disks

Fig. 12 shows an external appearance of the SCSI disks unit before and after retrofitting. A 3.5 type SCSI hard disks loaded in a supervisory control unit is renovated with an alternative replacement unit with a 2.5 type SATA hard disk. The major features are as follows:

- (1) Applicable to 12 types of hard disks used in existing equipment.
- (2) Modification on the controller side can be omitted (the same mounting method and the same size).
- (3) Power consumption and heat generation are lowered.

2.4.11 Replacement Unit for Digital Audio Tape (DAT) (for μ PORT-M2)

Fig. 13 shows a replacement unit for DAT.



Fig. 13 Substitute for DAT

This shows a substitute product of DAT using a Hard Disk Drive (HDD).

Since production of cassette streamers conventionally applied has been discontinued, this is a suitable replacement unit for data backup using the general-purpose equipment like PCs. The major features are as follows:

- (1) Maintenance and inspection
 - Applicable to the backup tools for OPS8000, μ PORT-M2, and μ PORT-M4.
- (2) HDD substitute for SCSI model (68Pin version)
 - (a) Reduction of data backup time: down to 1/3
 - (b) Data backup for multiple systems are possible by this single unit

2.4.12 Replacement Unit for Digital Controller HD1000

Replacement unit for HD1000 is applied to hydropower generation. This replacement unit is realized with a PLC and touch panel. Fig. 14 shows an external appearance of conventional HD1000 and a new combination of PLC + touch panel.

2.4.13 Development of Alternative Replacement Power Supplies (Substitute for Tele-Controller Source MVX28A)

Fig. 15 shows an alternative replacement

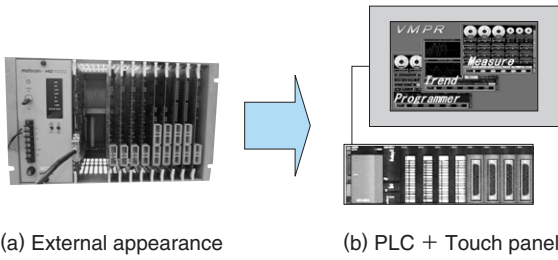


Fig. 14 HD1000

A substitute product of digital controller is shown, that is a combination of PLC and touch panel.

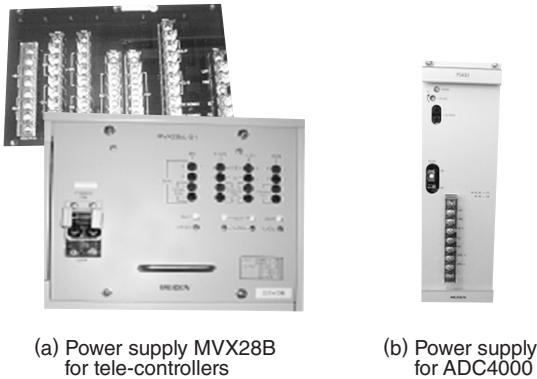


Fig. 15 Substitute Power Supply

Substitute products of various power supplies are shown for sequencers and tele-controllers. (a) Shows the back-to-back board developed and released as a substitute for the Faston terminal block. (b) Shows the substitute component obtained after redesigning.

power supply. As a result of the discontinuation of the production of Faston terminal blocks system components, the subject blocks were redesigned and replacement unit production has been carried out. The features are as follows:

- (1) Performance and functions are equivalent to those of the conventional items.
- (2) The same size and mounting method were adopted.
- (3) Therefore, connections can be made without changing external wiring.

3 Postscript

Maintenance of facilities and extension of operational life are always linked with the services of fixing, modification, extension, partial renovation, and others. Therefore, it is always important to try to secure alternative replacement items.

We will continue to supply various replacement items at every timely opportunity in order to support maintenance activities for facilities so that extension of facility life and partial renovation can be carried out, while keeping risk and cost minimum.

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