MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow **eco Changes**

Mitsubishi Programmable Controllers
MELSEC-AnS/QnAS (Small Type) Series
Transition Guide

From the MELSEC-AnS/QnAS (Small Type) Series to the

MELSEC-Q Series

AnS Q

Comprehensive, risk-free upgrade solutions

Oct. 2011 Edition

From the MELSEC-AnS/QnAS Series
➡ The MELSEC-Q Series

Complete Support for AnS/QnAs Series Upgrades

Mitsubishi Electric offers a carefully engineered combination of hardware, software, and support designed to allow you to upgrade legacy AnS and QnAS Series controller systems to the current MELSEC-Q Series with minimum disruption to your plant operations.

Upgrade Options

At-a-glance technical overviews

Technical Bulletins

Transition to made-to-order production (MELSEC-AnS/QnAS (small type) series)

FA-A-0094

- The information of transition to made-to-order production may be changed without notice. For the most recent information, contact your local MITSUBISHI representative.

In-depth technical documentation resources

Replacement Handbooks

Transition from MELSEC-AnS/QnAS (Small Type) Series to Q Series Handbook

- **Fundamentals**   L(NA)08219ENG
- **Intelligent function modules**   L(NA)08220ENG

Transition from MELSEC-A/QnA (Large Type), AnS/QnAS (Small type) Series to Q Series Handbook

- **Network Modules**   L(NA)08048ENG
- **Communications**   L(NA)08050ENG

Transition from MELSECNET/MINI-S3, A2C (I/O) to CC-Link Handbook

L(NA)08061ENG

Transition from MELSEC-I/OLINK to CC-Link/LT Handbook

L(NA)08062ENG

- For the products shown in handbooks for transition, catalogues, and transition examples, refer to the manuals for the relevant products and check the detailed specifications, precautions for use, and restrictions before replacement.
  For the products manufactured by Mitsubishi Electric Engineering Co., Ltd., Mitsubishi Electric System & Service Co., Ltd., and other companies, refer to the catalogue for each product and check the detailed specifications, precautions for use, and restrictions before use.
  The manuals and catalogues for our products, products manufactured by Mitsubishi Electric Engineering Co., Ltd., and Mitsubishi Electric System & Service Co., Ltd., are shown in Appendix of each handbook for transtion.
- Products shown in this handbook are subject to change without notice.

MEMO

Automatic Program Conversion: GX Developer & Q Conversion Support Tool

Minimize program conversion efforts by using GX Developer's PLC Type Change function and the Q Conversion Support Tool.

■The Q Conversion Support Tool boosts productivity by avoiding time spent consulting manuals for guidance on finishing program conversions.

Change to Q beforehand

Convert AnS/QnAS programs to Q programs
with GX Developer's PLC Type Change function.

AnS/QnAS program — PLC type change **GX Developer** → Q program
Original project Converted project

Enter the configuration information on the existing AnS/QnAS special function modules.
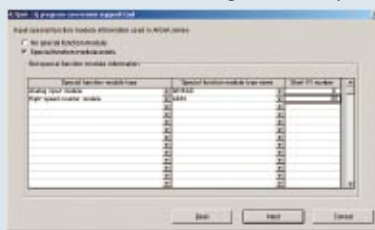
A/QnA → Q conversion support tool

Output

Differences between the two programs and guidance on how to complete the conversion are displayed.

Differences between two programs

<See 1 on p. 6.>

HTML conversion guidance file

<See 2 on p. 7-8.>
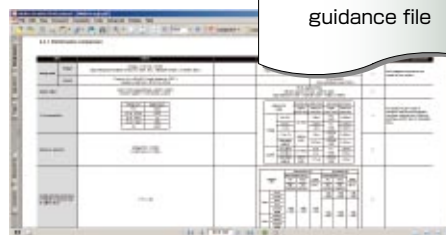
Point 1
●No need to manually compare the existing program with the converted program!

Point 2
●A list of unconverted instructions and devices is displayed.
●Information on recommended products for unconvertible special function modules is displayed.

Note 1: This support tool applies to ladder programs only.
Note 2: Conversion from AnS/Q2AS(H) programs to Q programs is also supported.
Note 3: The A/QnA → Q Conversion Support Tool does not support Universal model (QnU) CPUs. To convert a CPU to a Universal model QCPU, perform the following procedure.
　① Using GX Developer, change the PLC type of the original project to a PLC type which is supported by the A/QnA → Q Conversion Support Tool. (Converted project 1)
　② Again using GX Developer, change the PLC type of the original project to Universal model QCPU. (Converted project 2)
　③ Open the original project and the converted project 1 in the A/QnA → Q Conversion Support Tool.
　④ Reflect the output result from step 3 to the converted project 2.

1 Differences between the two programs

■Can be modified directly.
 Prevents mistakes and improves efficiency.
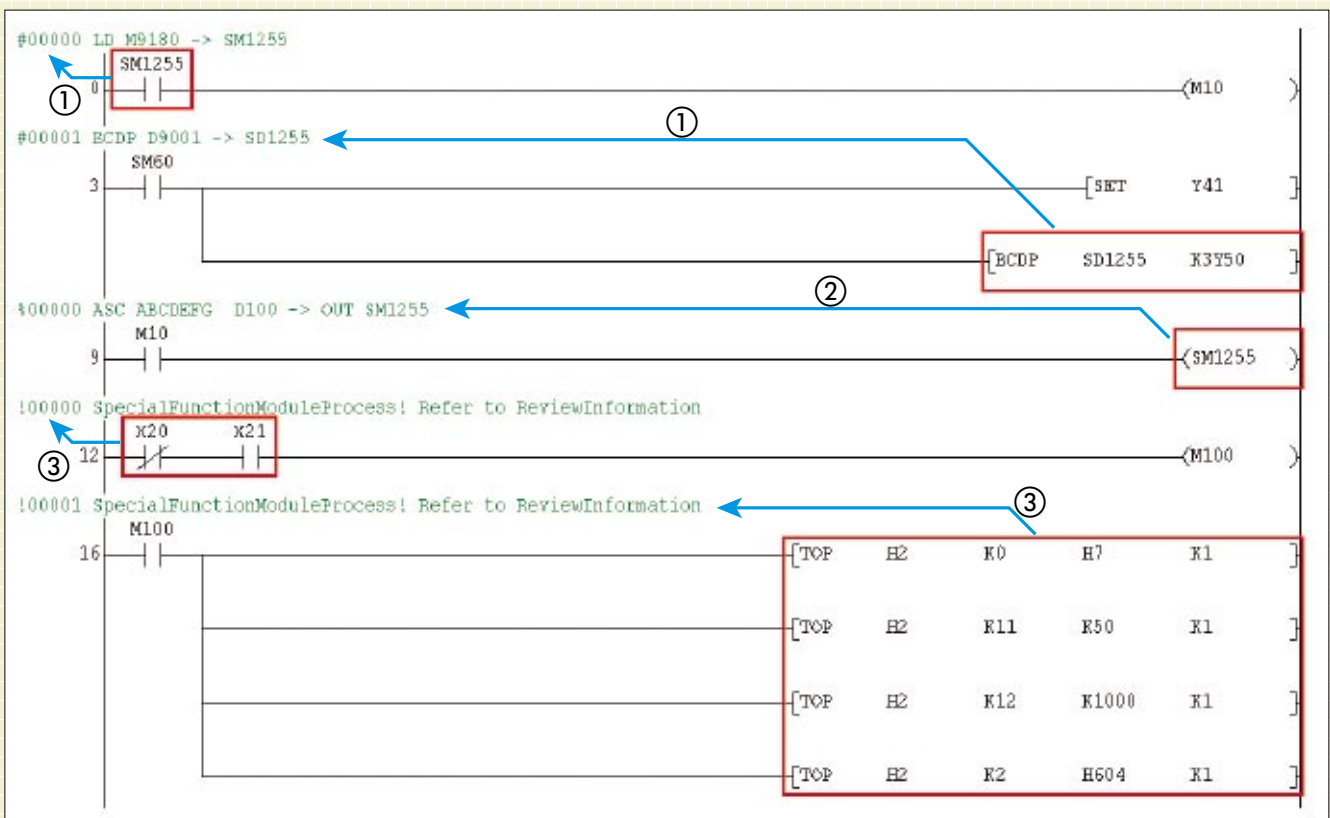
〈Image of differences between the two programs〉

①Statement of unconverted devices——#
　The original device and the converted device are displayed as shown below. The devices contained in the circuit block are displayed one line at a time.
　(E.g.)　#00001 ANI M9201 → SM1255
　　　　　("#00001" is a search keyword in the HTML conversion guidance file.)

②Statement of unconverted instructions——%
　The original instruction and the converted instruction are displayed as shown below. The instructions contained in the circuit block are displayed one line at a time.
　(E.g.)　%00001 [LRDP K3 D10 D100 K3] → OUT SM1255
　　　　　("%00001" is a search keyword in the HTML conversion guidance file.)

③Statement of special function module processes——!
　For the special function module instructions (FROM, DFRO, TO, DTO and instructions using X/Y devices), a message requesting review is displayed.
　(E.g.)　!00001 Spefical Function Module Process! Refer to ReviewInformation
　　　　　("!00001" is a search keyword in the HTML conversion guidance file.)

Automatic Program Conversion:
GX Developer & Q Conversion Support Tool

2 HTML conversion guidance file

■Easy comparison of performance specifications before and after replacement.

Detailed information is displayed hierarchically in your web browser. Information on the differences between the two programs and the conversion guidance file are linked together.

(Example 1) Special function module processes which need to be reviewed
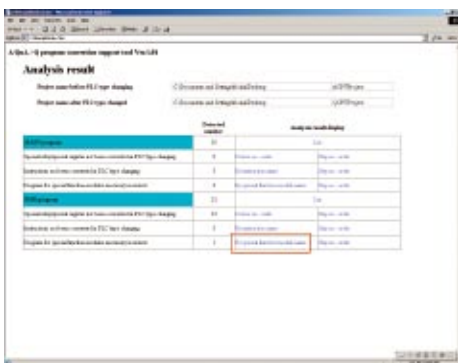
Click "By special function module name" in the "Programs for special function modules necessary in review" row.
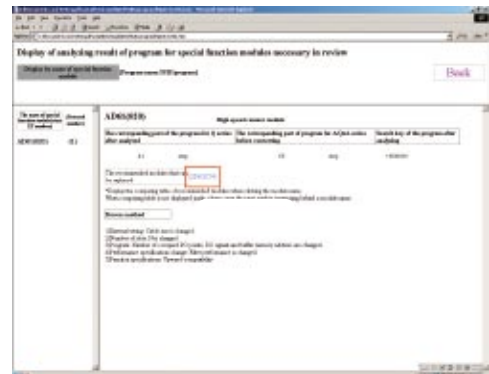
Click the recommended module name next to "The recommended modules that can be replaced."

■Details of unconverted special relays and registers can be displayed, improving conversion efficiency.

(Example 2) Special relays and registers which are not converted in the Q program
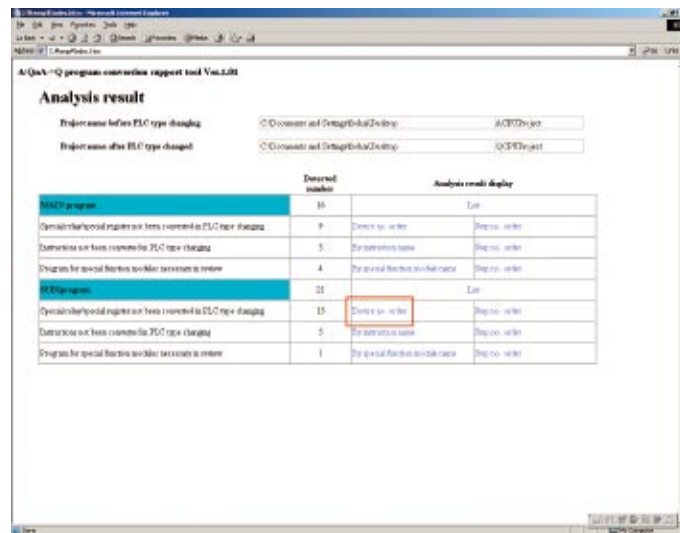
Click "Device no. order" in the "Special relay/special register not been converted in PLC type changing" row.
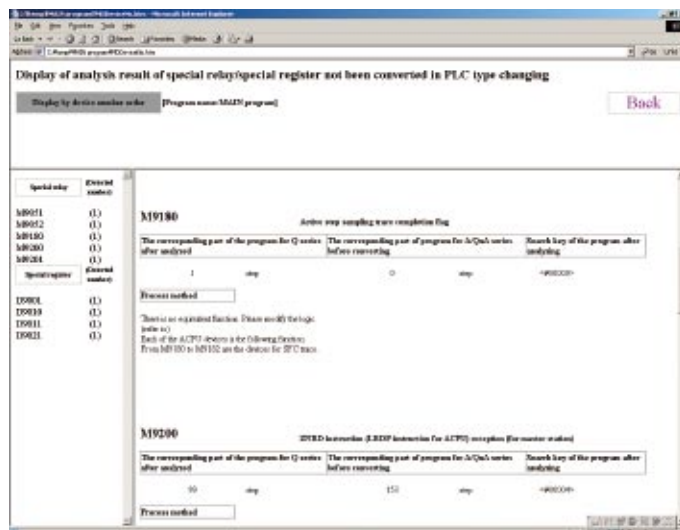
QA Extension Base Unit (QA1S65B / QA1S68B / QA1S51B) `Soon`

Use existing A Series modules when upgrading to QCPU.

■Gradual transition from small type Ans/QnAS Series to Q Series (Q mode).

●Construct a system that is controlled by the new Q Series CPU (Q mode) while keeping the existing small type AnS/QnAS Series modules mounted to a QA1S□B extension base unit. The AnS/QnAS Series modules can gradually be replaced to fully establish a Q Series system.

Existing small type
AnS/QnAS Series
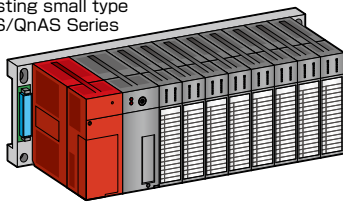
Step 1

Q Series
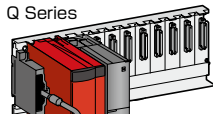
Q Series
extension
cable
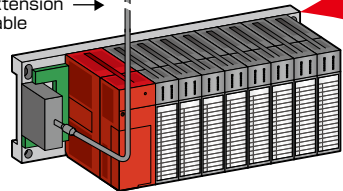
QA Extension
Base Unit
(QA1S65B)
(QA1S68B)
(QA1S51B)

Existing small type AnS/QnAS power supply,I/O modules, and other modules can be utilized; wiring is left as it is.

Step 2

Q Series
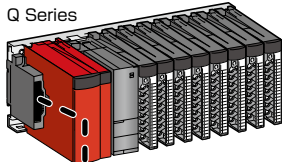
Entire replacement
with the Q Series
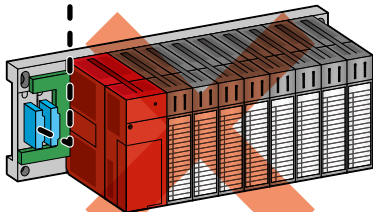
●Remove the QA extension base unit (QA1S□B) when all modules have been replaced with Q Series equivalents.

●It is recommended to use QA1S□B extension base units to gradually upgrade from AnS/QnAS Series system to Q Series system while using the assets of Small type Ans/QnAS series system (The QA1S□B extension base units are compatible with High Performance Model QCPUs only. Basic Model QCPUs, Process CPUs, Redundant CPUs, Safety CPUs,Universal Model QCPUs, and Remote I/O Stations are not compatible).

●Some modules cannot be mounted on the QA1S□B extension base units. For details, see the "QCPU User's Manual (Hardware Design, Maintenance and Inspection) (SH(NA)-080473ENG)".

■Reduce conversion effort by using the same I/O addressing.

When reusing existing modules with a Q Series CPU, it is not required to change the I/O number of the existing modules. For new module(s) on the main base unit, assign a number after the existing modules in the I/O assignment settings. This can greatly reduce the program modification time.

Q35B

| | 0 | 1 | 2 | 3 | 4 |
| QO6HCPU | QJ61BT11N | QJ71LP21-25 | QX41 | QX41 | QY41P |

Replaced modules (A to Q)   Newly added modules

| | 0 | 1 | 2 | 3 | 4 |
| A1SHCPU | A1SX41 | A1SY41P | A1SJ61BT11 | A1SJ71LP21 | A1SX41 |

QA1S□B extension base unit

| | 5 | 6 | 7 | 8 | 9 |
| A1SX41 | A1SY41P | Empty | Empty | A1SX41 |

Replace modules which cannot be mounted with Q Series modules.
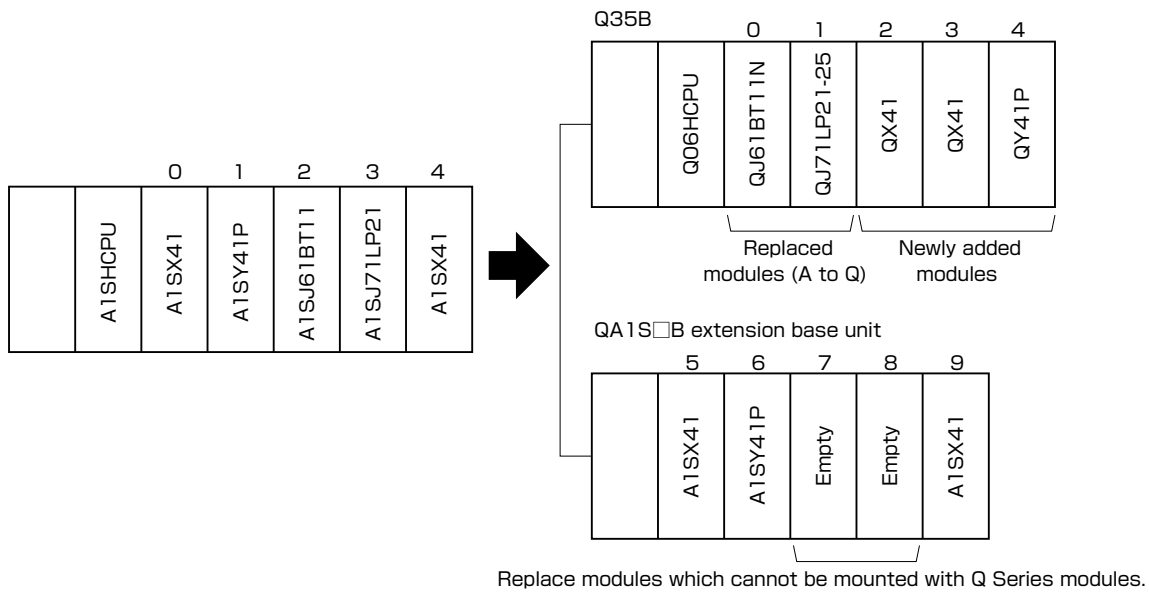
Note: Assign the I/O numbers in the following order: Q Series to A Series or A Series to Q Series.
When the order is mixed (i.e., Q Series → A Series → Q Series), an error will occur in the CPU.

■Example of I/O assignment

		Model	Type	Point	Address
Main base unit	0	QJ61BT11N	Intelli.	32	100
	1	QJ71LP21-25	Intelli.	32	120
	2	QX41	Input	32	140
	3	QX41	Input	32	160
	4	QY41P	Output	32	180

		Model	Type	Point	Address
Extension base unit	5	A1SX41	Input	32	00
	6	A1SY41P	Input	32	20
	7	——	Empty	32	40
	8	——	Empty	32	60
	9	A1SX41	Input	32	80

Upgrade Tool

Replace AnS Series systems with Q Series without extensive I/O rewiring.

■Upgrade tool features

The upgrade tool consists of two parts: a conversion adapter to modify the existing wiring of small-type AnS Series input/output/analog modules to the wiring of Q Series modules; and a Q Series base adapter mountable through the installation hole of the small-type AnS Series base unit.

● Remove the small type AnS Series programmable controllers along with the base unit, install the base adapter in the same position, and mount Q Series modules (New installation holes are unnecessary when mouting the base adaptor).

● Attach the conversion adapters to the Q Series modules.

● Remove the terminal blocks from the existing small type AnS Series modules and mount them on the conversion adapters (The existing wiring can be used without modification*).
  *Partial change in wiring for the power supply and common terminals is required.

Upgrade tool
(Base adapter)

Upgrade tool
(Conversion adapter)

* Replace a terminal block cover with the one included with a conversion adapter.

Utilize existing wiring of the I/O and other modules.
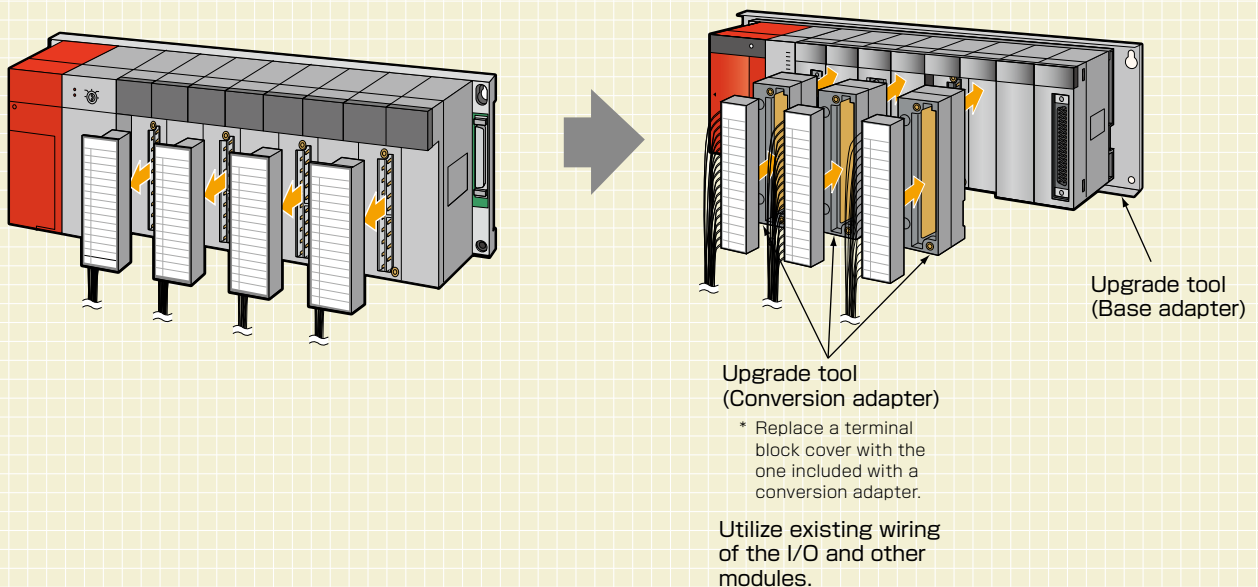
For detailed specifications, precautions, and restrictions of the upgrade tool, please refer to the brochure (NA C088E-116) and user's manual.
For the upgrade tool, please contact your local Mitsubishi sales office or representative.

■Conversion Adapter List

For input/output modules

Input / Output	AnS Series Model	Q Series Model	Conversion Adapter Model
Input	A1SX10	QX10	ERNT-ASQTXY10
	A1SX10EU		
Output	A1SY10	QY10	
	A1SY10EU		
Input	A1SX40	QX40	ERNT-ASQTX40
	A1SX40-S2		
	A1SX40-S1	QX40-S1	
	A1SX80	QX80	ERNT-ASQTX80
	A1SX80-S1		
	A1SX80-S2		
Output	A1SY22	QY22	ERNT-ASQTY22
	A1SY40 (P)	QY40P	ERNT-ASQTY40
	A1SY50	QY50	ERNT-ASQTY50
	A1SY80	QY80	ERNT-ASQTY80

*Partial change in wiring for the power supply and common terminals is required.

For analog modules

Input / Output	AnS Series Model	Q Series Model	Conversion Adapter Model
Input	A1S64AD	Q64AD	ERNT-ASQT64AD
	A1S68AD (Voltage input)	Q68ADV	ERNT-ASQT68AD
	A1S68AD (Current input)	Q68ADI	
Output	A1S62DA	Q62DAN	ERNT-ASQT62DA
	A1S68DAV	Q68DAVN	ERNT-ASQT68DA
	A1S68DAI	Q68DAIN	

■Base Adapter List

For main base units

AnS Series Model	Q Series Model	Base Adapter Model
A1S38B/A1S38HB	Q38B	ERNT-ASQB38
A1S35B	Q35B	ERNT-ASQB35
A1S33B	Q33B	ERNT-ASQB33
A1SJCPU	Q00JCPU	ERNT-ASQB00J
A1SJCPU-S3	Q00UJCPU	
A1SJHCPU		

For extension base units

AnS Series Model	Q Series Model	Base Adapter Model
A1S68B	Q68B	ERNT-ASQB68
A1S65B	Q65B	ERNT-ASQB65
A1S55B	Q55B	ERNT-ASQB55

■Instructions

● Check mounting conditions before using the upgrade tool, as the module width (34.5mm→27.4mm) and wiring space is decreased.

MELSEC-AnS Series module

34.5

MELSEC-Q Series module

27.4

● If cables interfere with the module, lift up the cables to the front to avoid interference.

Lift up the cables to the front to avoid interference.

Front

Existing cables of AnS series

AnS series terminal block

CPU module

Conversion adapter

Power supply module

Input/output/analog module

Back

● If the cables still interfere, leave an empty slot between modules to secure wiring space.

(Ex.) For Q38B

0 1 2 3 4 5 6 7

If slots are insufficient, add an extension base unit.
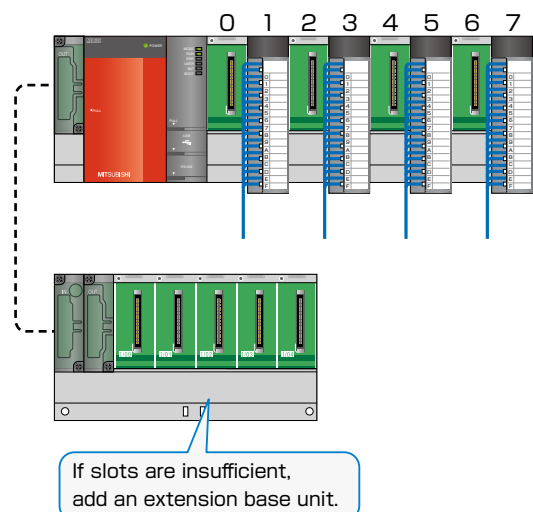
● Replace a terminal block cover with the one included with a conversion adapter.

Modules for Easy Replacement

A variety of modules are available to facilitate replacement.

■DC input modules compatible with 6mA rated input current (QX41-S2, QX81-S2)

Use modules that have a high rated input current and are compatible with proximity sensor inputs.

Common type	Small type AnS/QnAS Series	Q Series
Positive common	A1SX41[*1]	QX41-S2
	A1SX41-S2	
	A1SX42[*2,*3]	
	A1SX42-S2[*3]	
Negative common	A1SX81[*1]	QX81-S2
	A1SX81-S2	

*1: Use QX71 when 12VDC is selected.
*2: Use QX72 when 12VDC is selected.
*3: Use two QX41-S2s when using more than 32 points.

■Temperature control module (Q64TCTTN, Q64TCRTN, Q64TCTTBWN, Q64TCRTBWN) **New**

Temperature-control module can be replaced without changing the existing temperature sensor.

Temperature sensor	Small type AnS/QnAS Series	Q Series
Thermocouple	A1S64TCTT-S1	Q64TCTTN
	A1S62TCTT-S2	
	A1S64TCTRT	
Platinum resistance thermometers	A1S64TCRT-S1	Q64TCRTN
	A1S62TCRT-S2	
	A1S64TCTRT	
Thermocouple (Heater disconnection detection function)	A1S64TCTTBW-S1	Q64TCTTBWN
	A1S62TCTTBW-S2	
	A1S64TCTRTBW	
Platinum resistance thermometers (Heater disconnection detection function)	A1S64TCRTBW-S1	Q64TCRTBWN
	A1S62TCRTBW-S2	
	A1S64TCTRTBW	

■High-speed counter modules (QD62-H01, QD62-H02)

Modules can be replaced with no spec restrictions of the existing pulse generators (e.g. encoders etc.).

Counting speed	Small type AnS/QnAS Series	Q Series
50KPPS	A1SD61	QD62-H01
10KPPS		QD62-H02

* QD62-H01/H02 have 16 occupied I/O points. To utilize the programs before module replacement, set the same start numbers of I/O signal to the modules mounted to the right of the replaced high-speed counter module.
* The "limit switch output function" of A1SD61 can be substituted for the "coincidence output function" of QD62-H01/H02.

MELSECNET/H Network Module

QJ71NT11B (twisted bus type)

Utilize the existing MELSECNET/B twisted pair cables to build MELSECNET/H network systems.

■MELSECNET/H network system can be built using twisted pair cables.
Existing MELSECNET/B twisted pair cables are used to build the MELSECNET/H network system when replacing small type A Series modules (MELSECNET/B) with Q Series modules.
Modules are replaced without modifying the previously laid network cables.
A high-speed and large-volume network system can also be built using CC-Link cables.
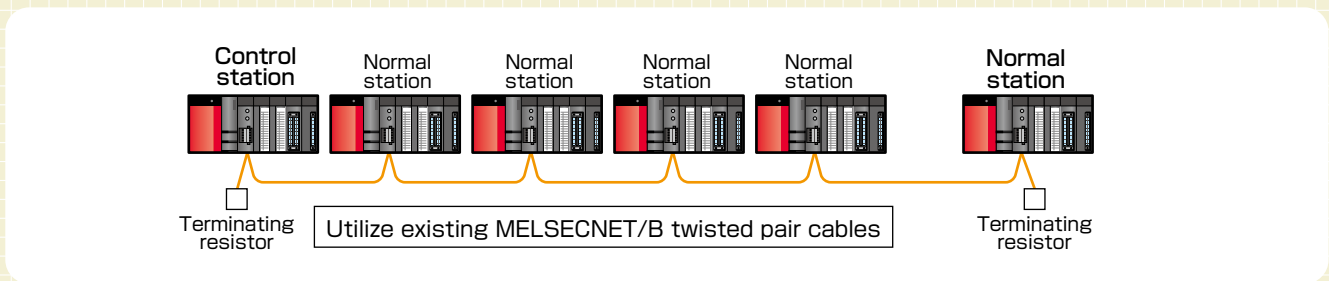
Item		Twisted bus system specification	
Number of stations per network		32 stations (1 control station, 31 normal stations)	
Cable type		Twisted pair cable	CC-Link Ver. 1.10 compatible cable
Overall distance per network		–	–
Communication speed	156 k bps	1200 m	1200 m
	312 k bps	600 m	900 m
	625 k bps	400 m	600 m
	1.25 M bps	200 m	400 m
	2.5 M bps	(N/A)	200 m
	5 M bps		150 m
	10 M bps		100 m

MELSECNET(Ⅱ), MELSECNET/B
Local Station Data Link Module (A1SJ71AP23Q A1SJ71AR23Q A1SJ71AT23BQ)

Upgraded AnS local station data link modules permit a direct Q Series connection to existing networks as local stations.

■Replace A Series MELSECNET(Ⅱ), MELSECNET/B stations with Q Series systems.

The MELSECNET(Ⅱ)/B local station data link modules allow a Q Series system to directly connect to existing NET(Ⅱ)/NET/B data link system via a QA1S□B extension base unit.

Example of a MELSECNET(Ⅱ) configuration incorporating the Q Series

High performance model QCPU

Master station

MELSECNET (Ⅱ)

Local station

Local station

Extension base unit with 1 slot (power supply module not required)

QA1S51B Soon
QA1S65B
QA1S68B

MELSECNET(Ⅱ), MELSECNET/B Local station data link module
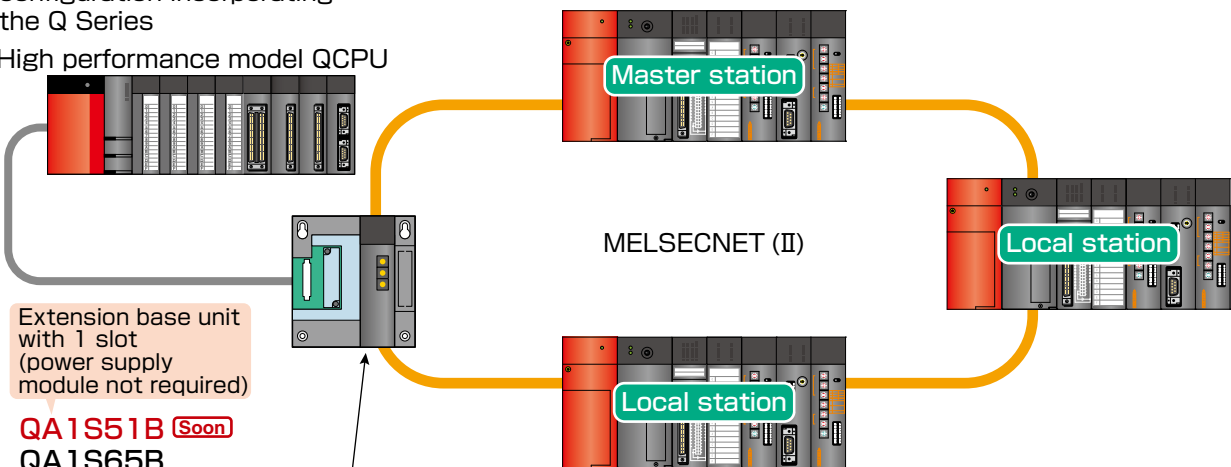
■Local station data link module options.

Model	Outline
A1SJ71AP23Q	MELSECNET(Ⅱ) local station data link module for SI optical fiber cable
A1SJ71AR23Q	MELSECNET(Ⅱ) local station data link module for coaxial cable
A1SJ71AT23BQ	MELSECNET/B local station data link module for shielded twisted pair cable

●Specifications

①Supported CPUs
High Performance Model QCPUs [Q02(H), Q06H, Q12H, and Q25HCPU]

②Compatible extension base units
QA1S□B or QA□B with A-A1S module conversion adapter (A1ADP)

③Number of modules per CPU
Send point range can be further increased by mounting up to 6 modules per CPU.

④Network parameters
Minimal setup required, as network parameters settings are automatically detected by the module.

⑤Link refresh setting
Link refresh setting is not automatically detected. Hence, FROM/TO instructions within sequence program to enable send/receive cyclic data are required.

Sample programs for link refresh are provided in the "A/QnA → Q Conversion Support Tool." The sample program can be used to create a QCPU program which may reduce development time.
For details, please contact your local Mitsubishi sales office or representative.

Responding to the amenable running of FA systems through an enhanced support system

Global FA Centers

"Mitsubishi Global FA Centers" are located throughout North America, Europe, and Asia to develop products complying with international standards and to provide attentive services.

○North American FA Center
Mitsubishi Electric Automation, Inc.
500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A
Tel: +1-847-478-2100 / Fax: +1-847-478-2253
Area covered: North America, Mexico, Chile, Brazil

○Brazil FA Center
MELCO-TEC Representacao Comercial e Assessoria Tecnica Ltda.
Av. Paulista, 1439, Cerqueira Cesar-Sao Paulo Brazil-CEP 01311-200
Tel: +55-11-3146-2200 / Fax: +55-11-3146-2217
Area covered: Brazil

○European FA Center
Mitsubishi Electric Europe B.V. Polish Branch
ul. Krakowska 50, 32-083 Balice, Poland
Tel: +48-12-630-4700 / Fax: +48-12-630-4701
Area covered: Central and Eastern Europe

○German FA Center
Mitsubishi Electric Europe B.V. -German Branch
Gothaer Strasse 8, D-40880 Ratingen, Germany
Tel: +49-2102-486-0 / Fax: +49-2102-486-1120
Area covered: Mainly Western Europe

○UK FA Center
Mitsubishi Electric Europe B.V. UK Branch
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, UK.
Tel: +44-1707-27-6100 / Fax: +44-1707-27-8695
Area covered: UK, Ireland

○Czech republic FA Center
Mitsubishi Electric Europe B.V. -o.s. Czech office
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Tel: +420-251-551-470 / Fax: +420-251-551-471
Area covered: Czech,Slovakia

○Russian FA Center
Mitsubishi Electric Europe B.V. Russian Branch St.Petersburg office
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Area covered: Russia

○Korean FA Center
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Area covered: Korea

○Shanghai FA Center
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4/F., Zhi Fu Plaza No.80 Xin Chang Road, Shanghai 200003, China
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Area covered: China

○Tianjin FA Center
Mitsubishi Electric Automation (CHINA) Ltd. Tianjin Office
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Tel: +86-22-2813-1015 / Fax: +86-22-2813-1017
Area covered: China

○Beijing FA Center
Mitsubishi Electric Automation (CHINA) Ltd. Beijing Office
Unit904-905, 9F, Office Tower, Henderson Centre, 18 Jianguomennei Avenue, Dongcheng District, Beijing, China
Tel: +86-10-6518-8830 / Fax: +86-10-6518-3907
Area covered: China

○Guangzhou FA Center
Mitsubishi Electric Automation (CHINA) Ltd. Guangzhou Office
Rm. 1609, North Tower, The Hub Center, No.1068, Xin Gang East Road, Haizhu District, Guangzhou, China
Tel: +86-20-8923-6730 / Fax: +86-20-8923-6715
Area covered: China

○Taiwan FA Center (Taipei)
Setsuyo Enterprise Co., Ltd.
3F., No.105, Wugong 3rd, Wugu Dist, New Taipei City 24889, Taiwan, R.O.C.
Tel: +886-2-2299-9917 / Fax: +886-2-2299-9963
Area covered: Taiwan

○Taiwan FA Center (Taichung)
Mitsubishi Electric Taiwan Co., Ltd.
No.8-1.Industrial 16th Road, Taichung Industrial Park, Taichung, Taiwan 407, R.O.C.
Tel: +886-(0)4-2359-0688 / Fax: +886-(0)4-2359-0689
Area covered: Taiwan

○ASEAN FA Center
Mitsubishi Electric Asia Pte. Ltd. ASEAN Factory Automation Centre
307 Alexandra Road #05-01/02, Mitsubishi Electric Building, Singapore
Tel: +65-6470-2460 / Fax: +65-6476-7439
Area covered: Southeast Asia, India

○India FA Center
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Area covered: Thailand

Product List

List of products used for upgrade

Extension base unit

Product name	Model	Outline
QA(1S) extension base unit	QA1S65B	5 slots, for AnS Series modules
	QA1S68B	8 slots, for AnS Series modules
	QA1S51B **Soon**	1 slot, for AnS Series modules (power supply module not required)

DC input module

Product name	Model	Outline
DC input module	QX41-S2	32 points, 24 V DC, rated input current: approximately 6 mA, positive common type, 32 points/common, response time: 1 ms/5 ms/10 ms/20 ms/70 ms or less (Set by the CPU parameter at the initial setting of 10 ms for both ON to OFF and OFF to ON)
	QX81-S2	32 points, 24 V DC, rated input current: approximately 6 mA, negative common type, 32 points/common, response time: 1 ms/5 ms/10 ms/20 ms/70 ms or less (Set by the CPU parameter at the initial setting of 10 ms for both ON to OFF and OFF to ON)

Temperature control module

Product name	Model	Outline
Temperature control module **New**	Q64TCRTN	4 channels, platinum resistance thermometers (Pt100, JPt100) No heater disconnection detection function Sampling cycle: 0.5s/4CH, 18-point terminal block
	Q64TCRTBWN	4 channels, platinum resistance thermometers (Pt100, JPt100) Heater disconnection detection function Sampling cycle: 0.5s/4CH, 18-point terminal block × 2
	Q64TCTTN	4 channels, thermocouple (K, J, T, B, S, E, R, N, U, L, PL2, W5Re/W26Re) No heater disconnection detection function Sampling cycle: 0.5s/4CH, 18-point terminal block
	Q64TCTTBWN	4 channels, thermocouple (K, J, T, B, S, E, R, N, U, L, PL2, W5Re/W26Re) Heater disconnection detection function Sampling cycle: 0.5s/4CH, 18-point terminal block × 2

High-speed counter module

Product name	Model	Outline
High-speed counter module	QD62-H01	Replacement module with the same input filtering system and counting speed as A1SD61 (50KPPS)
	QD62-H02	Replacement module with the same input filtering system and counting speed as A1SD61 (10KPPS).

MELSECNET/H twisted bus type network module

Product name	Model	Outline
MELSECNET/H twisted bus type network module	QJ71NT11B	MELSECNET/H twisted pair cable, single bus, for control/normal station

MELSECNET(II), MELSECNET/B local station data link module

Product name	Model	Outline
MELSECNET(II) local station data link module	A1SJ71AP23Q	MELSECNET(II) local station data link module for SI optical fiber cable
	A1SJ71AR23Q	MELSECNET(II) local station data link module for coaxial cable
MELSECNET/B local station data link module	A1SJ71AT23BQ	MELSECNET/B local station data link module for shielded twisted pair cable
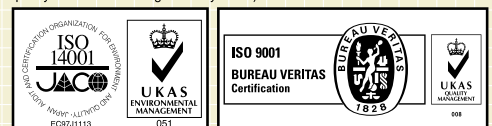
Mitsubishi Programmable Controllers
MELSEC-AnS/QnAS Series Transition Guide

Precautions before use

This publication explains the typical features and functions of the products herein and does not provide restrictions and other information related to usage and module combinations. Before using the products, always read the product user manuals. Mitsubishi Electric will not be held liable for damage caused by factors found not to be the cause of Mitsubishi Electric; opportunity loss or lost profits caused by faults in Mitsubishi Electric products; damage, secondary damage, or accident compensation, whether foreseeable or not, caused by special factors; damage to products other than Mitsubishi Electric products; and to other duties.

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- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi.
- The products have been manufactured under strict quality control. However, when installing the products where major accidents or losses could occur if the products fail, install appropriate backup or fail-safe functions in the system.

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