UNIVERSIDAD AUTONOMA DE NUEVO LEON

FACULTAD DE INGENIERIA MECANICA Y ELECTRICA

INTRODUCCION A LA AUTOMATIZACION INDUSTRIAL
A BASE DE PLC's

TESINA
QUE PARA OBTENER EL TITULO DE
INGENIERO EN CONTROL Y COMPUTACION

PRESENTA
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La Facultad de Ingeniería Mecánica y Eléctrica de la Universidad Autónoma de Nuevo León

otorga el presente

Credo del Ingeniero

Siento profundo orgullo por mi profesión,
sin vanagloria le debo solemne obligación,
que estoy ansioso de dar cumplimiento,
así lo manifiesto en este juramento.

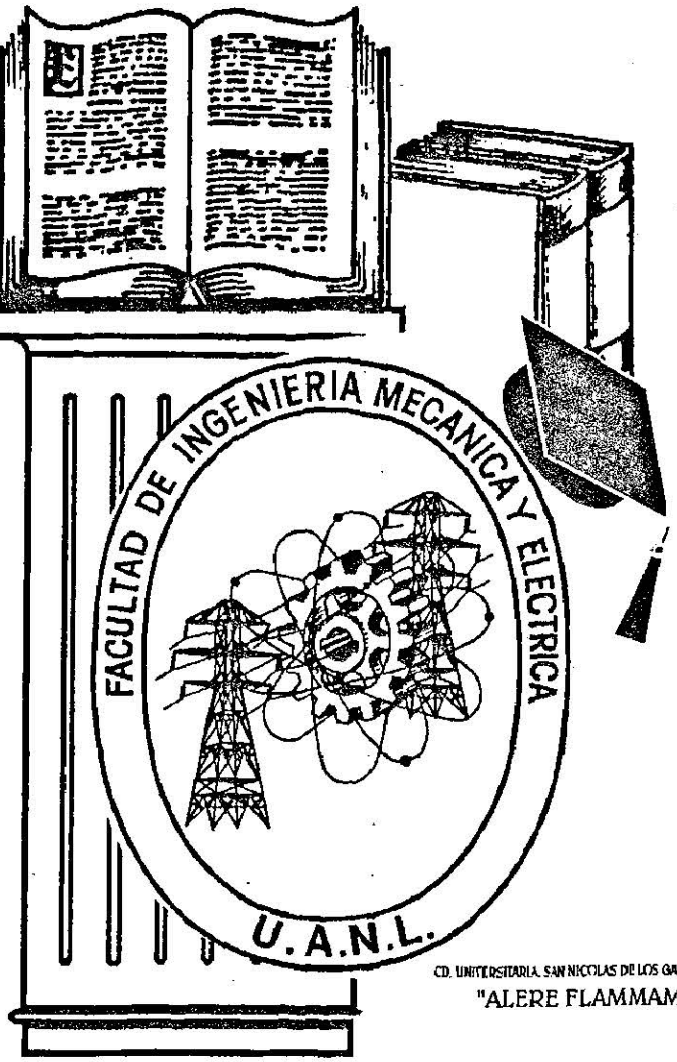
La primera regla aquí propuesta,
es jamás participar en empresa deshonesta,
quien me contrate como patrón o cliente,
ofrezco trabajo de calidad y en el precio ser consciente.

Como parte que soy de la humanidad,
si son necesarios mis servicios y capacidad,
serán gratuitos para el bien de la comunidad.

Celoso de la alta reputación de mi vocación,
lucharé por los intereses sin vacilación,
de algún colega que requiera protección,
pero no dudaré si mi deber lo dictara,
en revelar la verdad a quién impactara,
aquel que se haya mostrado indigno de la profesión.

Mi antepasado hizo con su mano maravilla,
trabajando la piedra, el cobre y la arcilla,
más tarde trabajó el bronce y el hierro,
dominó tierras y mares saliendo del encierro,
conquistó la energía y los materiales,
con la tecnología unió las tierras continentales,
puso en práctica los principios de la ciencia,
con mucho orgullo recibo yo su herencia,
prometo a la cultura ingenieril dar diseminación,
a toda aquella persona que necesite educación.

A mis colegas y compañeros, ofrezco,
en la misma medida que lo solicito y merezco,
cooperatividad, trabajo de equipo y respeto,
de la información técnica, no guardar secreto,
ser fiel a las normas de nuestra profesión,
llevar en la conciencia que nuestra obligación,
es servir a la humanidad con sincera devoción.



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"ALERE FLAMMAM VERITATIS"

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INTRODUCCION

El Controlador Lógico Programable o PLC es un instrumento electrónico a base de microprocesadores y es utilizado para la automatización de procesos industriales, mediante un programa previamente diseñado y cargado a la memoria del mismo.

Los PLC`s fueron desarrollados en la década de los 60`s y su principal objetivo fue el de sustituir a los circuitos de control mediante relevadores, debido al gran costo y al gran mantenimiento que estos requieren.

Algunas especificaciones que deben seguirse son:

- El sistema de control mediante PLC`s deberá ser más barato que el tradicional con relevadores.
- Deberá operar en ambiente industrial.
- Su diseño deberá ser de arquitectura modular, para que sus componentes puedan ser fácilmente reemplazados.
- El sistema deberá ser reusable.

Estas se lograron y aún se mejoran, por lo que fueron aplicadas con éxito a principio de la década de los 70`s. Los primeros PLC`s ofrecieron funcionalidad en la relevación, reemplazando así la lógica relevatorista y el uso en ambiente industrial fue alcanzado.

El primer controlador programable no era mas que un simple sustituto de relevadores, consumía menos espacio y energía, tenían indicadores de diagnostico que ayudan a la solución de problemas y eran capaces de control ON-OFF por lo que su aplicación principal era en procesos repetitivos.

De los años 1970 a 1974 se desarrolló la industria del microprocesador trayendo consigo las grandes ventajas del PLC, adquiriendo más inteligencia, más capacidad aritmética y además capacidad de comunicación.

Después de 1975 el auge en el desarrollo de Hardware permitió a los controladores programables disponer de una cantidad de proceso de almacenamiento de datos, la introducción del manejo de entradas y salidas remotas, así como de sistemas analógicos, considerable reducción en el cableado y encamina a los controladores a dar el gran salto del control ON-OFF a control de instrumentación.

Desde principios de los 80`s muchos avances tecnológicos han producido cambios que no sólo modificaron el diseño del controlador, sino que también modificaron la filosofía en el diseño de sistemas de control.

Al referirnos al PLC debemos hablar de el concepto que nos permite controlar un sistema de producción mediante la adquisición de datos del proceso, su tratamiento y la ejecución de acciones para mantener el control de dicho proceso, este concepto es Automatización.

Cualquier proceso de Automatización en general, responde a una serie de secuencias de operaciones que pueden ser sistemas lógicos combinacionales, es decir, dependen solamente del estado de las entradas, o sistemas lógicos secuenciales que dependen sólo de las condiciones de las entradas, además de la secuencia de estados de sistemas.

El controlador lógico programable es capaz de resolver únicamente una instrucción a la vez, de un conjunto ordenado y de ahí el concepto de tratamiento secuencial de la información.

Las funciones que anteriormente eran manipuladas por sistemas de control alambrados, ya sea de relees o de estados sólidos, ahora son realizadas previamente y desarrolladas por computadora. El controlador programable monitorea continuamente las condiciones de los dispositivos conectados como entradas y controla su salida basado en instrucciones que el operador almacena en la memoria programable del mismo PLC.

CONTROLADOR LOGICO PROGRAMABLE (PLC)

El Controlador Lógico Programable (PLC) es un instrumento electrónico a base de microprocesadores, el cual es utilizado para la automatización de procesos industriales, mediante un programa previamente diseñado en formato escalera y cargado de la memoria del mismo.

Este es capaz de almacenar instrucciones para implementar funciones de control tales como secuencia, regulación de tiempo, conteo, aritmética, manipulación de datos y comunicaciones con máquinas y procesos industriales.

Un controlador programable puede verse en términos simples como una computadora industrial.

* VENTAJAS DEL PLC

- Facilitan la detección de fallas (autodiagnóstico, leds indicadores de estado).
- Son reusables ya que no se diseñan para una actividad específica.
- Son fácilmente realambrables y reprogramables.
- Son confiables debido a su fabricación de microprocesadores y circuitos electrónicos.
- Están diseñados para uso industrial, ya que soportan altas temperaturas, variaciones de voltaje, vibraciones, ruido magnético, etc.
- Son pequeños, requieren relativamente poco espacio.
- Simplifican el alambrado y reducen el costo del mismo.
- Son relativamente económicos.
- Su programación es simple.
- Son prácticamente libres de mantenimiento.
- Son flexibles ya que se pueden aplicar en gran variedad de procesos, debido a que pueden manejar diferentes tipos de señales y niveles.
- Son de construcción modular, para facilitar el intercambio de elementos.

* DESVENTAJAS DEL PLC

- Se usan sólo en control no en potencia, ya que la corriente máxima de salida es de 3 Amp. a 120 Volts en algunos modelos.
- No presentan una información gráfica, aunque estas limitaciones desaparecen adaptándole pantallas o monitores para observar el proceso.

* CARACTERÍSTICAS DEL PLC

- Capacidad para realizar funciones matemáticas.
- Capacidad de comunicación e interacción con el operador.
- Capacidad para comunicarse con computadoras.
- Mayor capacidad de memoria.
- Entradas y salidas remotas.
- Instrucciones más poderosas.
- Autodiagnóstico.
- Mayor velocidad de scaneo.
- Interfases de entrada y salida que permiten procesamiento distribuido (PID, ASCII, posicionamiento y módulo de lenguaje).
- Interfaces especiales que permiten que ciertos dispositivos se conecten al controlador como celdas de carga, entradas de respuesta rápida.

* ESTRUCTURA DEL PLC

El Programador Lógico Programable está integrado por los siguientes elementos:

FUENTE ABASTECEDORA

Es un circuito electrónico que convierte el VCA en VCD y debe tener la capacidad de corriente para proveer de energía al CPU y en los módulos de entrada y salida.

PROCESADOR (CPU)

Es el cerebro del controlador donde reside la memoria del usuario y el procesador el cual ejecuta el programa almacenado en la memoria., genera todas las señales necesarias para la adquisición y tratamiento de la información, así como también controla el resto del circuito y además es la parte inteligente del equipo.
Desempeña como función principal el intercambio de información con el sistema de entrada y salida y el tratamiento procesado de dicha información de acuerdo con las instrucciones acerca del estado interno del sistema así como la manipulación de puertos de comunicación para equipos de programación y otros periféricos.

RACK

Es el gabinete debidamente diseñado con conector tipo peine para insertar o quitar fácilmente los módulos que contengan. Está dividido en slots, cada slot puede alojar un módulo.

MODULO DE I/O

Un dispositivo de entrada/salida es cualquier elemento que intercambia información con el procesador. Los módulos de entrada mandan información al procesador y los módulos de salida reciben la información del procesador.

- Módulo de Entrada: son aquellos módulos que reciben la información de dispositivos externos que ejercen la acción para mantener el control del proceso, tales como temperatura, presión, movimiento, posición, etc. Algunos de ellos son muy simples y sólo requieren de un cable de conexión, pero otros son más complejos y requieren de un adaptador para hacer llegar la señal al procesador.
- Módulo de Salida: son aquellos módulos a través de los cuales se envían señales para actuar dispositivos externos que ejercen la acción para monitorear el control del proceso.
- Módulos de Entrada y Salidas Locales: son aquellos módulos que se encuentran en el mismo rack que el CPU o Rack Local.
- Módulos de Entradas y Salidas Remotas: son aquellos módulos que se encuentran en un rack remoto.

Las funciones principales de estos módulos son identificar las señales para que el procesador pueda realizar en forma efectiva el control, proporcionando un aislamiento entre los circuitos eléctricos de las tensiones de campo y adaptan las tensiones de los dispositivos de entradas y salidas a niveles lógicos (5 a 12 VCD).

MEMORIA

La memoria del procesador está dividida en tres áreas perfectamente diferenciadas y con funciones especificas, las cuales son:

- Memoria No Accesible: el operador no tiene acceso a esta memoria la cual contiene programas grabados por el fabricante, necesarios para que el microprocesador usado trabaje adecuadamente.
- Memoria Accesible: está destinada para almacenar el programa de control generado por el usuario para cada aplicación. En general es una memoria volátil (RAM) para facilitar las tareas de programación y modificación del programa.
- Memoria de Direccionamiento: también llamadas memorias de almacenaje o tabla de registros; contienen la información relativa a los estados de las variables de entrada y salida, así como la información generada por el procesador (timers, contadores, etc.).

El estado de las variables de entrada y salida queda reflejado en una posición particular (bit) de la tabla de egistros, representados por un valor binario 1 o 0 (ON-OFF activado o desactivado), de esta manera el procesador puede reconocer cada una de las señales de entrada y salida.

PROGRAMADOR

Es un instrumento utilizado para insertar la lógica de operación de proceso, mediante instrucciones de programación del CPU, además sirve para monitorear el estado de los elementos programados.

BATERIA

Es una batería de litio de larga duración, la cual sirve para respaldar la información del CPU en el momento en que este se encuentre desenergizado. El tiempo de vida es de dos años en operación aproximadamente y fuera de operación es de 8 a 10 años.

* FUNCIONAMIENTO DEL PLC

La función básica del controlador programable es leer todos los dispositivos de entrada y ejecutar el programa, el cual de acuerdo a la lógica programada ajustará los dispositivos de salida a ON u OFF. Este proceso de lectura de entradas, ejecución del programa y actualización de las salidas es conocido como Scan.

El tiempo que tarda el PLC para implementar el Scan se reconoce como tiempo de Scan, este tiempo está compuesto por el tiempo del Scan del programa y el tiempo de actualización de I/O.

Este tiempo depende de la cantidad de memoria del programa y el tiempo de instrucciones usadas en el mismo, además de la existencia de subsistemas remotos.

FABRICACION DE PASTA PARA ACUMULADORES.

Este proyecto se realizó en base a el proceso manual en la fabricación de pasta para fabricar placas de un acumulador, siendo automatizada sólo parte de este.
La información del proceso se obtuvo de la planta de Acumuladores Mexicanos para obtener un proceso real y para la automatización del proceso será utilizado un Controlador Lógico Programable (PLC) MICRO - 1.

El proceso está dividido en las siguientes etapas:

- Reactor Barton
- Tolva de Sedimentación
- Cámara de Filtros de Sacos
- Silos o Tolvas
- Molino Raymond
- Silos o Tolvas de Almacenamiento
- Banda Transportadora de Polvo (Gusano)
- Banda Transportadora Vertical de Cuchara (Elevador de Cajilones)
- Banda Transportadora Horizontal
- Tolva Pesadora
- Revolvedora (Batidora)
- Fin del Proceso

Las etapas a automatizar son las siguientes:

- Silos o Tolvas de Almacenamiento
- Banda Transportadora de Polvo (Gusano)
- Banda Transportadora Vertical de Cuchara (Elevador de Cajilones)
- Banda Transportadora Horizontal
- Tolva Pesadora
- Revolvedora (Batidora)

DESCRIPCION MANUAL DEL PROCESO

El proceso para formar el óxido de plomo comienza introduciendo el plomo puro en estado sólido a una olla de Crisol, el cual es fundido a una temperatura de 450° a 490° C.. Después ya en forma de líquido es transportado por medio de gravedad pasando por una tubería con cierta inclinación a un Reactor Barton, el cual se encuentra enterrado y tiene una alimentación de aire; en este Reactor el plomo pasa de su estado líquido a polvo paletizado.

El plomo puro reacciona con el oxígeno separando en partículas óxidas de plomo.El aire que entra en el Reactor no está controlado automáticamente, ésto sólo se controla en forma manual determinando una de las características que debe cumplir el óxido de plomo la cual es el porcentaje de plomo libre, en función de este resultado si es muy alto o bajo se le aumenta el volumen o se disminuye.

En el Reactor Barton existe un termopar el cual si detecta una alta temperatura manda una señal a una válvula solenoide para que deje pasar agua y así reduzca su temperatura, si llegara a detectar una temperatura baja manda la señal a la válvula para reducir el flujo de agua.

Cuando el óxido de plomo sale del Reactor, sale con un determinado tamaño de partículas proporcinal al grano de azúcar y este no es suficiente ya que entre mayor sea el tamaño de éstas menos capacidad de absorción tiene.

Posteriormente son enviadas al Molino Raymond para disminuir el tamaño de las partículas y aumentar su densidad ya que se encarga de convertirlas a un tamaño más fino proporcinal al de los granos de harina, por medio de succión es transportado a una Tolva de Sedimentación por medio de un canal administrado por aire a presión, se tiene que dejar a que repose por lo menos 24 horas mínimo y que tenga una temperatura ambiente o menor a los 50°C..
En este proceso existen dos tipos de partículas, las ligeras y las pesadas.

En la Tolva de Sedimentación las partículas pesadas bajan a un canal que las transporta directamente a la Cámara de Filtros de Sacos y las partículas ligeras se quedan arriba de la misma, donde son transportadas por medio de una turbina ciclónica a un silo y después de ahí las pasa a la cámara de filtros de sacos donde cada partícula se adhiere a los sacos, estos sacos vibran y dejan caer las partículas ligeras donde se fusionan con las partículas pesadas para después ser transportadas a los silos de almacenamiento correspondientes a la empastadora, hasta ahí el proceso es manual.

COMPONENTES DEL PROCESO A AUTOMATIZAR

* SENSOR DE FLUJO

La operación de éstas unidades consiste en la separación de líquidos exactamente en la medida del incremento y el movimiento del líquido, cada segmento de líquido es contado por una conexión de registro porque cada incremento representa un volumen discreto, las unidades de desplazamiento positivo es una forma popular de un grupo automático y el conteo de las aplicaciones. Los medidores de dsplazamiento positivo son buenos candidatos para la medida de flujo, de líquidos viscosos o para el uso donde se necesita una simple medida mecánica del sistema.

* VALVULAS DE CONTROL DIRECCIONAL

Una válvula de control direccional consiste en un cuerpo con conductores internos que conecta y desconecta por medio de una parte móvil como ya se había señalado, tanto en las válvulas direccionales como en la mayoría de las válvulas hidráulicas industriales, el vástago constituye la parte interna móvil. En la hidráulica industrial el tipo de la válvula direccional que más se utiliza es la válvula de vástago. Por este motivo se describen estos tipos de válvulas y su operación.

- VALVULA DIRECCIONAL DE 2 VIAS: consiste de dos conductos que se conectan y desconectan, cuando el vástago está en un extremo se abre paso de flujo a través de la válvula. En el otro extremo, el flujo queda obstruido.

- VALVULA DIRECCIONAL DE 2 VIAS EN UN CIRCUITO: la función de las válvulas direccionales de dos vías es de conexión y desconexión, esta función se utiliza en la mayoría de los sistemas, como un enclavamiento de seguridad y para aislar y conectar las diversas partes del sistema.

* CAPACIDAD NOMINAL Y MEDIDAS DE LA VALVULA DIRECCIONAL.

Las válvulas de control direccional que se utilizan en las aplicaciones de hidráulica industrial se pueden adquirir en cinco medidas básicas: $^1/_4$ ", $^3/_8$", $^1/_2$", $^3/_4$" y 1 $^1/_4$".

La práctica industrial más común es fijar la capacidad nominal en 12-20 $^{1}/_{min}$., 30/40 $^{1}/_{min}$., 80 $^{1}/_{min}$., 280 $^{1}/_{min}$ y 400 $^{1}/_{min}$ respectivamente. A esta capacidad nominal en $^{1}/_{min}$ el diferencial de la presión de P a A o de B a T es de 3 $^{Kg}/_{cm^2}$ aproximadamente.

* SOLENOIDE

Una de las maneras más comunes de operar una válvula direccional es por medio de un solenoide, que es un dispositivo eléctrico que básicamente consiste en un émbolo, una caja y una bobina de alambre, la bobina se enrolla dentro de la caja. El émbolo está libre para moverse dentro de la bobina. Cuando una corriente eléctrica pasa a través de una bobina de alambre se genera un campo magnético atrae a el émbolo y lo lleva dentro de la bobina, al moverse el émbolo entra en contacto con un pasador de empuje, desplazando el vástago de la válvula direccional hacia un extremo.

- LIMITACIONES DEL SOLENOIDE: las válvulas direccionales operadas a solenoide tienen pocas limitaciones, no se pueden utilizar solenoides comunes cuando se utiliza un sistema hidráulico en un medio ambiente húmedo o explosivo. Cuando el ciclo de vida de una válvula direccional deba ser extremadamente prolongado no se utilizan solenoides controlados electrónicamente. Probablemente, la mayor desventaja de los solenoides es que la fuerza que ellos ejercen para desplazar el vástago de una válvula direccional es limitada en realidad, la fuerza necesaria para desplazar el vástago de una válvula direccional es importante en las de mayor tamaño, como resultado, las válvulas direccionales utilizan directamente los solenoides para desplazar un vástago con medida de $^{1}/_{4}$" y $^{3}/_{8}$".

Se opera por presión piloto hidráulica, en muchos casos a estas válvulas más grandes se les instala una válvula direccional operada por solenoides de $^{1}/_{4}$" o $^{3}/_{8}$" sobre la parte superior de la válvula más grande cuando es necesario el desplazamiento, el flujo se lleva de la válvula pequeña hacia cualquier xtremo del vástago de la válvula más grande. Estas válvulas se denominan válvulas direccionales operadas a piloto controladas por solenoide.

* SENSOR DE PESO (STRAIN GAGE)

Un transductor que es usado en la medición de fuerza o peso es el Strain Gage, el más común de los varios tipos disponibles es la Resistencia Strain Gage.

Las Galgas Extensiométricas (Strain Gage) se basan en la vibración de longitud y de diámetro y por lo tanto de resistencia, que tiene lugar cuando un hilo de resistencia se encuentra sometido a una tensión mecánica por la acción de una presión.

Existen dos tipos de Galgas Extensométricas: Galgas Sementadas formadas por varios bucles de hilo muy fino que están pegados a una hoja, base de cerámica, papel o plástico y Galgas Sin Sementar en las que los hilos de resistencia descansan entre una armazón fija y otra móvil bajo una ligera tensión inicial. En ambos tipos de Galgas, la aplicación de presión estira o comprime los hilos según sea la disposición que el fabricante haya adoptado modificando la resistencia de los mismos.

La galga forma parte de un Puente de Wheastone y cuando está sin tensión tiene una resistencia eléctrica determinada. Se aplica al circuito una tensión nominal tal que la corriente pequeña que circula por la resistencia crea una tensión nominal en la misma y el puente se equilibre para estas condiciones.Las Galgas Extensiométricas pueden alimentarse con corriente contínua o alterna ya que tienen una respuesta excelente y puede utilizarse en medidas estáticas y dinámicas. Presenta una compensación de temperatura relativamente fácil y generalmente no son influidas por campos magnéticos con excepción de las Galgas de Silicio difundido por poseer las siguientes desventajas: señal débil, pequeños movimientos de Galgas, alta sensibilidad a vibraciones y estabilidad dudosa a lo largo del tiempo de funcionamiento.La Galga de Silicio difundido tiene la ventaja adicional de estar en contacto directo con el proceso sin mecanismos intermedios de medición de presión pudiendo así trabajar correctamente aunque el flujo se deposite parcialmente sobre el diafragma del elemento ya que mide directamente la presión del fluido y no la fuerza que este hace sobre el diafragma.

* BANDAS TRANSPORTADORAS

Las Bandas Transportadoras que se utilizan en este proceso están especialmente diseñadas para trasladar polvo (óxido de plomo), estos tipos de bandas deben estar totalmente selladas para evitar la pérdida de polvo ya que el aire podría hacer volar estas partículas.

Los tipos de Bandas Transportadoras son:

- Tipo Gusano
- De Cuchara (Elevador de Cajilones)
- Horizontal de Rodillos

Las Bandas tipo Gusano tiene una distancia aproximada de $^{1}/_{8}$" entre la pared de la tubería y el Gusano, esta tubería es de tipo férula y tiene partes para observar lo que se está transportando, además de no tener obstrucción como tornillos, etc.
Entre Banda y Banda Tipo Gusano hay válvulas rotatorias que forzan al óxido a que caiga de una y alimente a la otra.

DESCRIPCION DEL PROCESO A AUTOMATIZAR

Una vez que los silos están llenos o por lo menos uno, el desarrollo del proceso es el siguiente:
se abre la compuerta del silo para dejar pasar el material, el material se traslada a través de una Banda Transportadora de Polvo (Tipo Gusano), sube por una banda llamada De Cuchara o Elevador de Cajilones y al final por una Banda Horizontal de Rodillos que deposita el material en la Tolva Pesadora. Cuando el material en la Tolva Pesadora llega a los 1000 Kg. se abrirá la compuerta de la tolva para dejar caer el material, agua y el ácido, obteniéndose así la pasta para las placas de los acumuladores.

FUNCIONAMIENTO DEL PROCESO CON EL PLC

Para que el proceso inicie su funcionamiento, primero oprimimos el botón de START que nos indica la entrada y acciona un contador con un preset de 3 en donde cada pulso del contador compara con la FUN 100 si existe material en las tolvas, el cual se simula manualmente con las entradas 0 o SW 3, 4 y 5, si no existe material en las tolvas se energiza la bobina externa 214 que nos indica que no hay material.

Al dar la señal de que existe material en cualquiera de las tres tolvas con las entradas o SW 3, 4 y 5 oprimir el RESET MANUAL que nos seleccionará la tolva que se va a vaciar, al seleccionar una de las tres tolvas que se va a vaciar energizamos el contacto 0 (START) manualmente, para darle START se necesita que exista material en una de las tres tolvas, si no exite no enciende la señal de arranque 400.

Al energizar el contacto o entrada 1 (STOP) manualmente se detiene el proceso.

Se genera una alarma de prearranque cuando se oprima el botón de START, encontrándose material en cualquiera de las tres tolvas y se energiza la bobina 400 y enciende la bobina 215 que es la alarma o buzzer de prearranque, al mismo tiempo la bobina 400 arranca un TIMER 0 de 2 seg. de duración, cuando pasa este tiempo el contacto T 0 se abre y apaga la alarma o buzzer de arranque.

También tendremos una alarma que funcionará cuando exista material y realizará sonidos espaciados. Después de que termine el sonido de la alrma de prearranque, el contacto T 0 se energiza y enciende la Banda Gusano (bobina 203), dando un tiempo de retardo de 1 seg., arranca el TIMER 1 y se enciende la Banda Vertical (Elevador de Cajilones, bobina 204), con la misma bobina 204 se cierra el contacto 204 y energizará el TIMER 2 con duración de 1 seg., después de transcurrido este tiempo se energizó la Banda Cuchara (bobina 205).Ya después de haber arrancado las tres bandas se procederá a abrir las compuertas según la tolva que tengamos seleccionada manualmente la cual dejará pasar material con respecto al CONTADOR 0, un ejemplo de esto es, si seleccionamos la tolva 1 cuando en CONTADOR 0 cuente 0 se abrirá la compuerta de dicha tolva y dejará pasar material a las bandas, así con el RESET MANUAL indicaremos la tolva seleccionada, el material se tramsporta por las bandas a una Tolva Pesadora que al llegar al peso de 1000 KG. los cuales se simulan con la entrada o SW manual 6 (contacto 6) que energiza la bobina 402, también al contacto 402, esta misma bobina abre los contactos 402 que desenergizan las bandas para que no siga cayendo material a la Tolva Pesadora, también el contacto 402 energiza el TIMER 6 de 2 seg. de duración, al término de este tiempo cierra el contacto T 6 que abre la compuerat de la Tolva Pesadora (bobina 210) al momento que abrió la compuerta de la Tolva Pesadora 210 cierra el contacto 210 que enciende la Revolvedora que es la la bobina 213, con la misma señal de la bobina 213 se cierra el contacto 213 y enciende la válvula de agua que se necesita (simulado manualmente), se cierra dicha válvula con la entrada o SW 7 al mismo tiempo que cerraremos el contacto 7 accionaremos la válvula de ácido que es la bobina 212.

Al término de cierta capacidad de ácido que se necesita (simulado) se cerrará manualmente la válvula de ácido con la entrada o SW 10, al mismo tiempo que cerramos el contacto 10 accionaremos la bobina 401 que al mismo tiempo cierra su contacto 401 y energiza el TIMER 7 que es el tiempo de batido de 20 seg., este TIMER cierra su contacto T 7 y se resetea el TIMER 7 con la 401 que también desenergiza la compuerta de la Tolva Pesadora y la Revolvedora accionando nuevamente el sistema con la Banda Gusano repitiendo el ciclo de bandas.

El SW o entrada 1 (STOP) sirve para limpiar o apagar el sistema así como banda tras banda.
Cuando damos el STOP se cae la señal 400 mencionada con anterioridad, cuando se carga la señal 400 arranca el TIMER 3 que tiene una duración de 3 seg. que es el tiempo que se tarda la Banda Gusano en transportar el material a la siguiente banda y se apaga la banda suponiendo que no lleva material. Después cierra el contacto T 3 y energiza el TIMER 4 que tiene una duraciónde 3 seg., se apaga la Banda vertical y se cierra el contacto T 4, se energiza el TIMER 5 que al pasar 3 seg. apaga la Banda Cuchara.

INSTRUCCIONES ESPECIALES DE HIGIENE Y SEGURIDAD

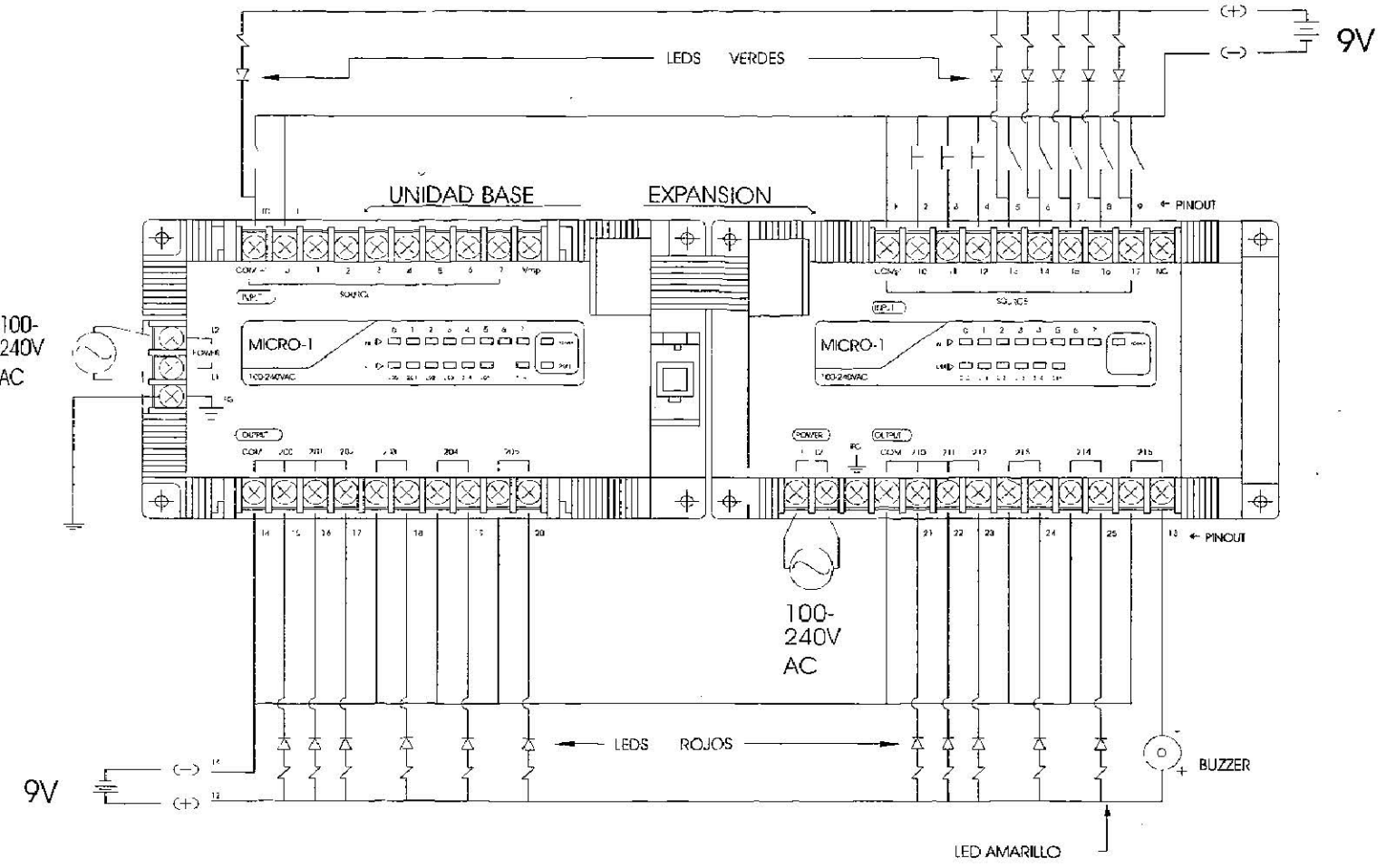
Para conservar su área de trabajo limpia y en orden lavar periódicamente con agua la máquina , al hacer esto las parrillas de pasta seca son removidas lo cual de otra manera contribuyen a altos niveles de plomo en el aire.
tener cuidado de no poner agua en la tolva porque cambiaría la consistencia de la pasta. Además evitará regar el agua en el motor y caja de engranes, porque la pasta puede ser forzada en los sellos. Inmediatamente lubricar la máquina, limpiar la banda con agua y un cepillo con fibra, esto produce buenas placas y alargan la vida de la banda. Si se deja que la pasta se endurezca puede romper las fibras de la banda y destruye la capacidad absorbente de la banda. Se debe también lavar el rodillo exprimidor y el raspador asegurándose que todas las trazas de pasta sean removidas.

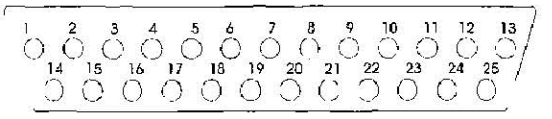
Cuando agregue el exceso de pasta a la tolva cuidar de su peso, la pasta húmeda es muy pesada y por lo tanto se debe tener cuidado. No agregar grandes cantidades de pasta a la vez porque la densidad de la pasta tiende a cambiar.

Después de haber usado la batidora debe lavarse perfectamente, ya que podríamos tener contaminaciones en las pastas, lo que sería motivo par rechazar el lote.

En la limpieza debe incluirse la tapa de la batidora, el distribuidor de ácido, la entrada de óxido a la batidora y el sistema de extracción donde se encuentra la compuerta.

DIAGRAMA ELECTRICO



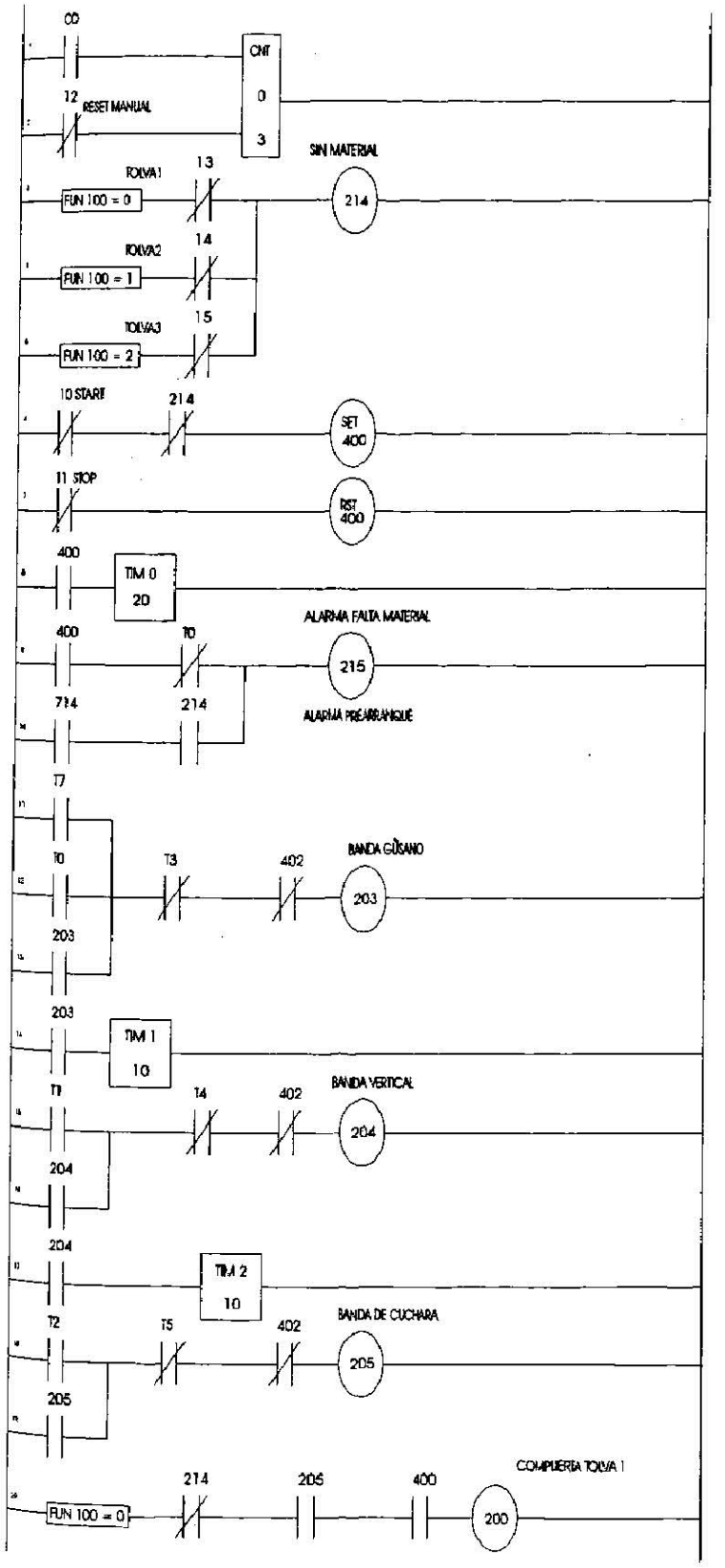


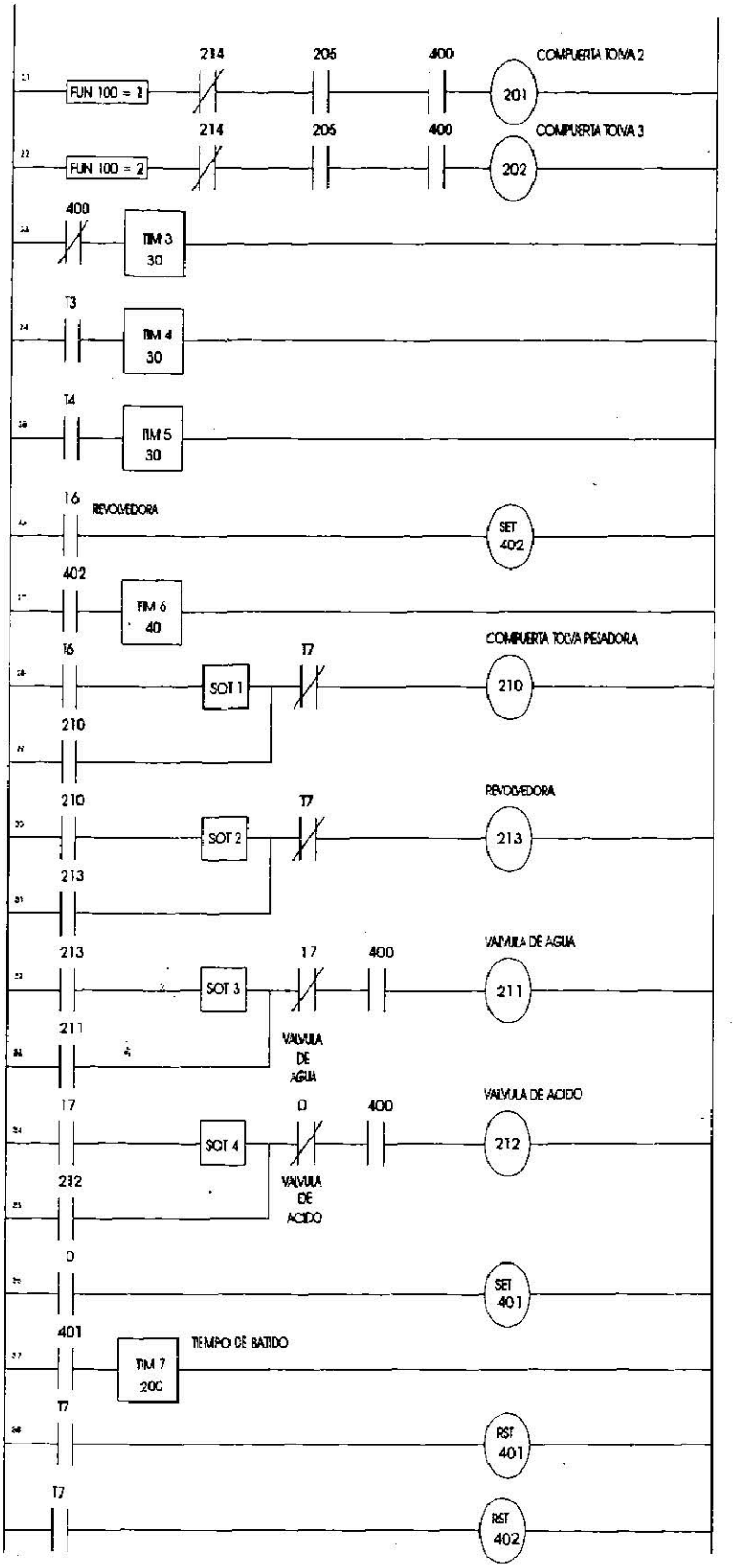
PINOUT

1.- COM (-)
2.- START
3.- STOP
4.- RESET MANUAL
5.- TOLVA 1
6.- TOLVA 2
7.- TOLVA 3
8.- TOLVA PESADORA
9.- VALVULA DE AGUA
10.- VALVULA DE ACIDO
11.-COM (-)
12.- +9V
13.- BUZZER O ALARMA
14.- COM(-)
15.- COMPUERTA TOLVA 1
16.- COMPUERTA TOLVA 2
17.- COMPUERTA TOLVA 3
18.- BANDA DE GUSANO
19.- BANDA VERTICAL
20.- BANDA DE CUCHARA
21.- COMPUERTA TOLVA PESADORA
22.- COMPUERTA AGUA
23.- COMPUERTA ACIDO
24.- REVOLVEDORA
25.- SIN MATERIAL

NOTA: TODAS LAS RESISTENCIAS DE 220 Ω 1/2W.

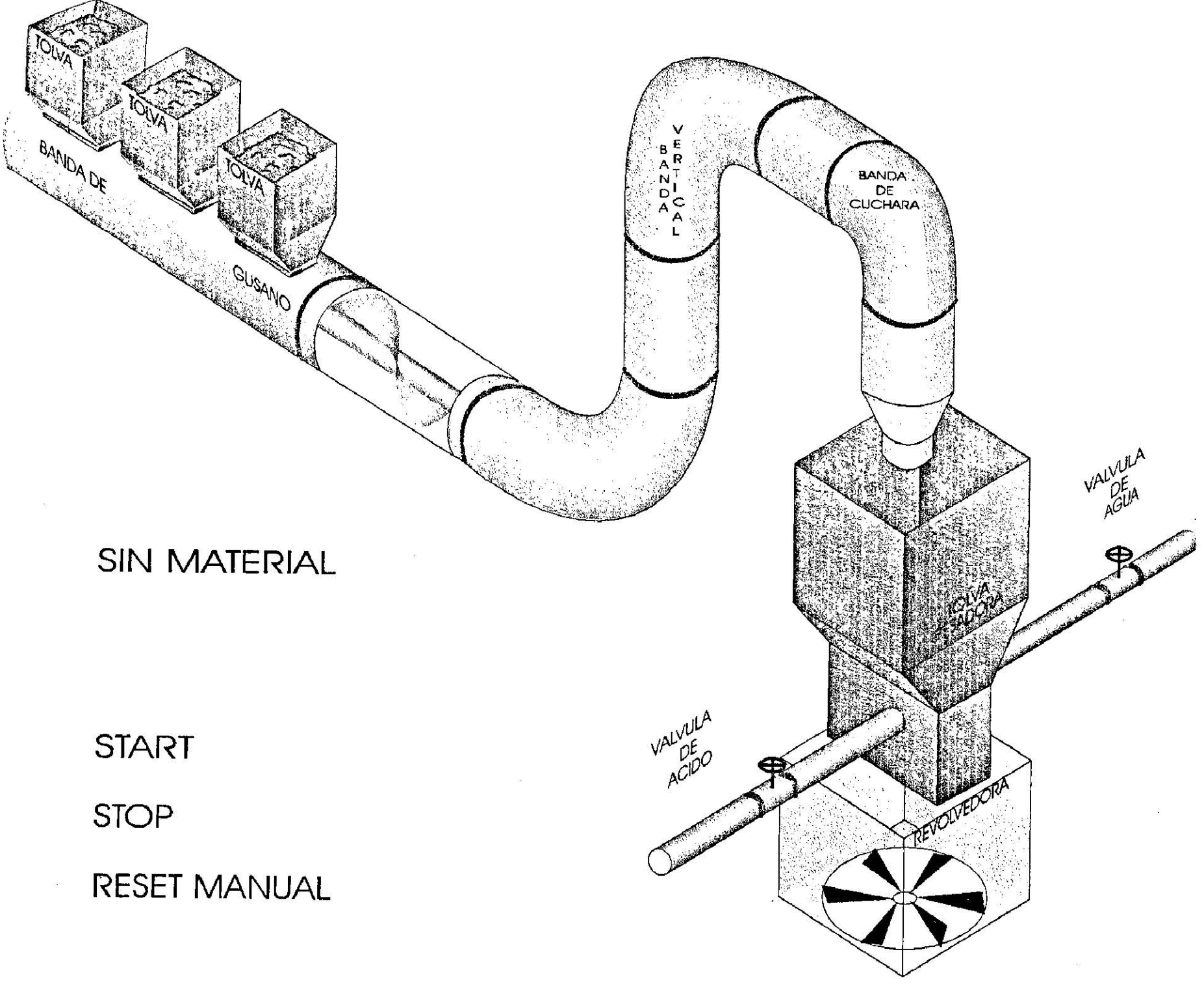
DIAGRAMA ESCALERA





CODIFICACION

OOOOO	LOD C O	OOO39	LOD T 1	OOO78	30
OOOO1	LODN 12	OOO40	OR 204	OOO79	LOD 16
OOOO2	CNT 0	OOO41	AND N T 4	OOO80	SET 402
OOOO3	3	OOO42	AND N 402	OOO81	LOD 402
OOOO4	FUN 100	OOO43	OUT 204	OOO82	TIM 6
OOOO5	0	OOO44	LOD 204	OOO83	40
OOOO6	AND N 13	OOO45	TIM 2	OOO84	LOD T 6
OOOO7	FUN 100	OOO46	10	OOO85	SOT 1
OOOO8	1	OOO47	LOD T 2	OOO86	OR 210
OOOO9	AND N 4	OOO48	OR 205	OOO87	AND N T 7
OOO10	OR LOD	OOO49	AND N T 5	OOO88	OUT 210
OOO11	FUN 100	OOO50	AND N 402	OOO89	LOD 210
OOO12	2	OOO51	OUT 205	OOO90	SOT 2
OOO13	AND N 5	OOO52	FUN 100	OOO91	OR 213
OOO14	OR LOD	OOO53	0	OOO92	AND N T 7
OOO15	OUT 214	OOO54	AND N 214	OOO93	OUT 213
OOO16	LODN 10	OOO55	AND 205	OOO94	LOD 213
OOO17	AND N 214	OOO56	AND 400	OOO95	SOT 3
OOO18	SET 400	OOO57	OUT 200	OOO96	OR 211
OOO19	LODN 11	OOO58	FUN 100	OOO97	AND N 17
OOO20	RST 400	OOO59	1	OOO98	AND 400
OOO21	LOD 400	OOO60	AND N 214	OOO99	OUT 211
OOO22	TIM 0	OOO61	AND 205	OO100	LOD 7
OOO23	20	OOO62	AND 400	OO101	SOT 4
OOO24	LOD 400	OOO63	OUT 201	OO102	OR 212
OOO25	AND N T 0	OOO64	FUN 100	OO103	AND N 0
OOO26	LOD 714	OOO65	2	OO104	AND 400
OOO27	AND 214	OOO66	AND N 214	OO105	OUT 212
OOO28	OR LOD	OOO67	AND 205	OO106	LOD 0
OOO29	OUT 215	OOO68	AND 400	OO107	SET 401
OOO30	LOD T 0	OOO69	OUT 202	OO108	LOD 401
OOO31	OR T 7	OOO70	LOD N 400	OO109	TIM 7
OOO32	OR 203	OOO71	TIM 3	OO110	200
OOO33	AND N T 3	OOO72	30	OO111	LOD T 7
OOO34	AND N 402	OOO73	LOD T 3	OO112	RST 401
OOO35	OUT 203	OOO74	TIM 4	OO113	RST 402
OOO36	LOD 203	OOO75	30		
OOO37	TIM 1	OOO76	LOD T 4		
OOO38	10	OOO77	TIM 5		



SIN MATERIAL

START

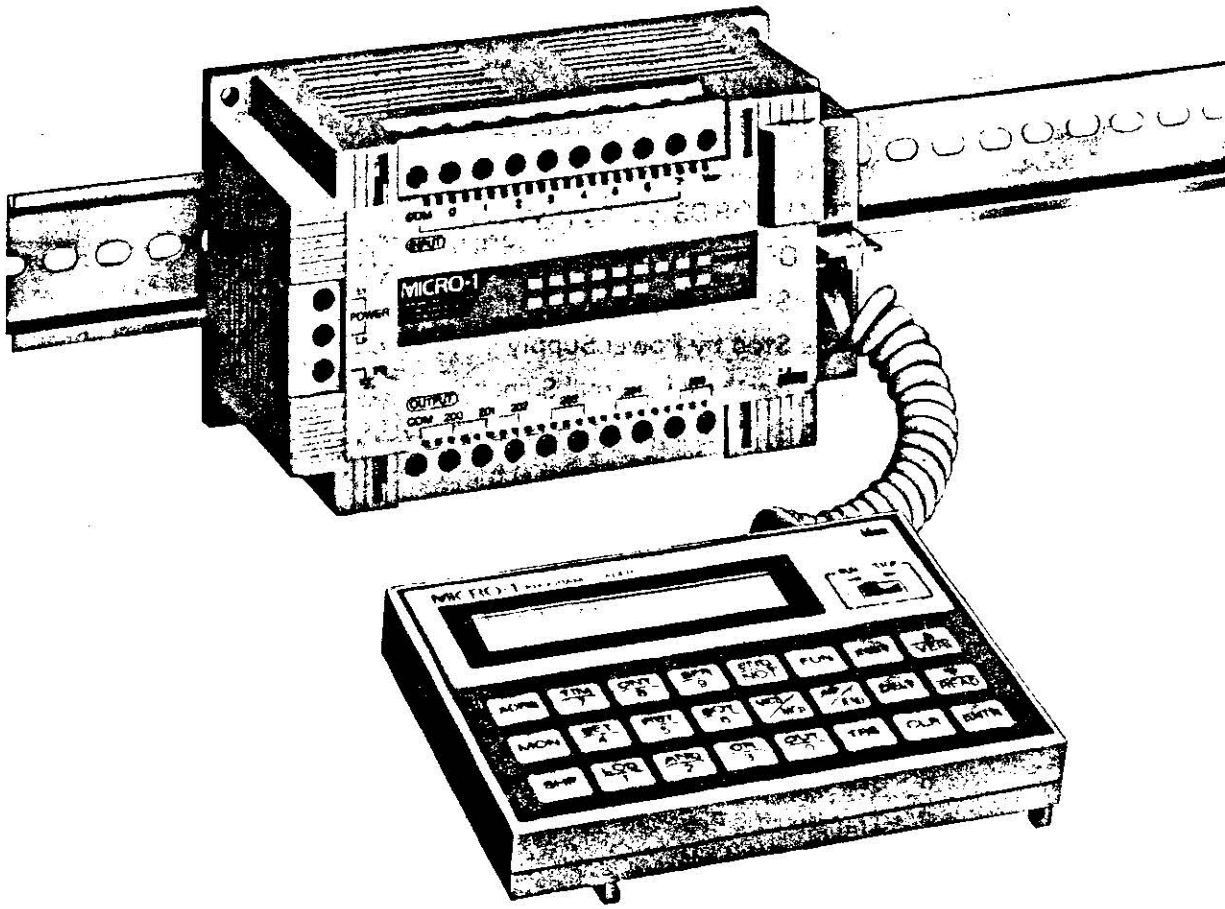
STOP

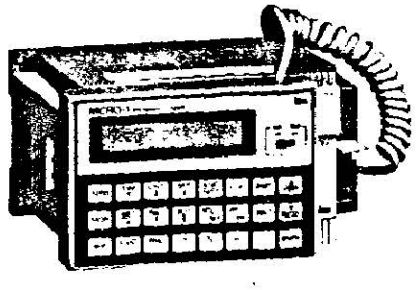
RESET MANUAL

MICRO PROGRAMMABLE CONTROLLER

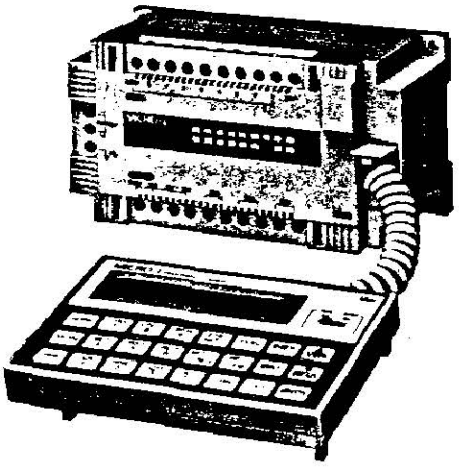
MICRO-1

USERS MANUAL





CONTENTS



FEATURES

Micro Programmable Controller For Small Machine Control With Selected Functions and Easy Operation

8 or 16 inputs
6 or 12 outputs
Program capacity 600 steps

Micro programmable controller ideal for small machine control.

The MICRO-1 base unit measures only 140W x 80H x 74D mm, just as large as three standard timers of the DIN48mm-square size. The compact body uses the least panel space where space around a machine is highly valued.

Supersedes relay control circuits.

The MICRO-1 base unit costs no more than the total cost of 10 relays and 3 timers of IDEC's standard models. The MICRO-1 with shift register and external display functions is more cost-effective than relay control circuits.

Expansion up to 16 inputs and 12 outputs.

The base unit has 8 inputs and 6 outputs. Expansion units are available to add 8 inputs and 6 outputs; thus the MICRO-1 can control a total of 16 inputs and 12 outputs.

Easy programming.

Programming can be done on the small hand-held program loader using the familiar relay symbol format.
IDEC's FA series program loader can also be used for programming.
Application software Control Logic Input Program (CLIP) is available for programming on an IBM or compatible personal computer.

EEPROM memory allows program modification.

The MICRO-1 base unit stores user programs in built-in EEPROM memory without the need for a backup power supply. Since user programs can be modified or replaced, the MICRO-1 is ideal for production lines of many different models in small quantities.
Using the FA series program loader allows for FA series memory packs to store user programs.

Wide range of power voltage.

The MICRO-1 base unit is available in two power voltage types: AC type operates on 100 to 240V AC and DC type operates on 24V or 12V DC.

0.5msec catch input.

The MICRO-1 is provided with a catch input to accept a 0.5msec pulse input signal. Short pulse inputs can be accepted regardless of the scan time.

DIN rail mounting.

The MICRO-1 base unit can snap-mount on a 35mm-wide DIN rail as well as on a panel surface using screws.

Computer link function.

A maximum of 32 MICRO-1 base units can be linked to an IBM or compatible personal computer for network communication. Remote control panels and machines can be controlled and monitored on the personal computer.

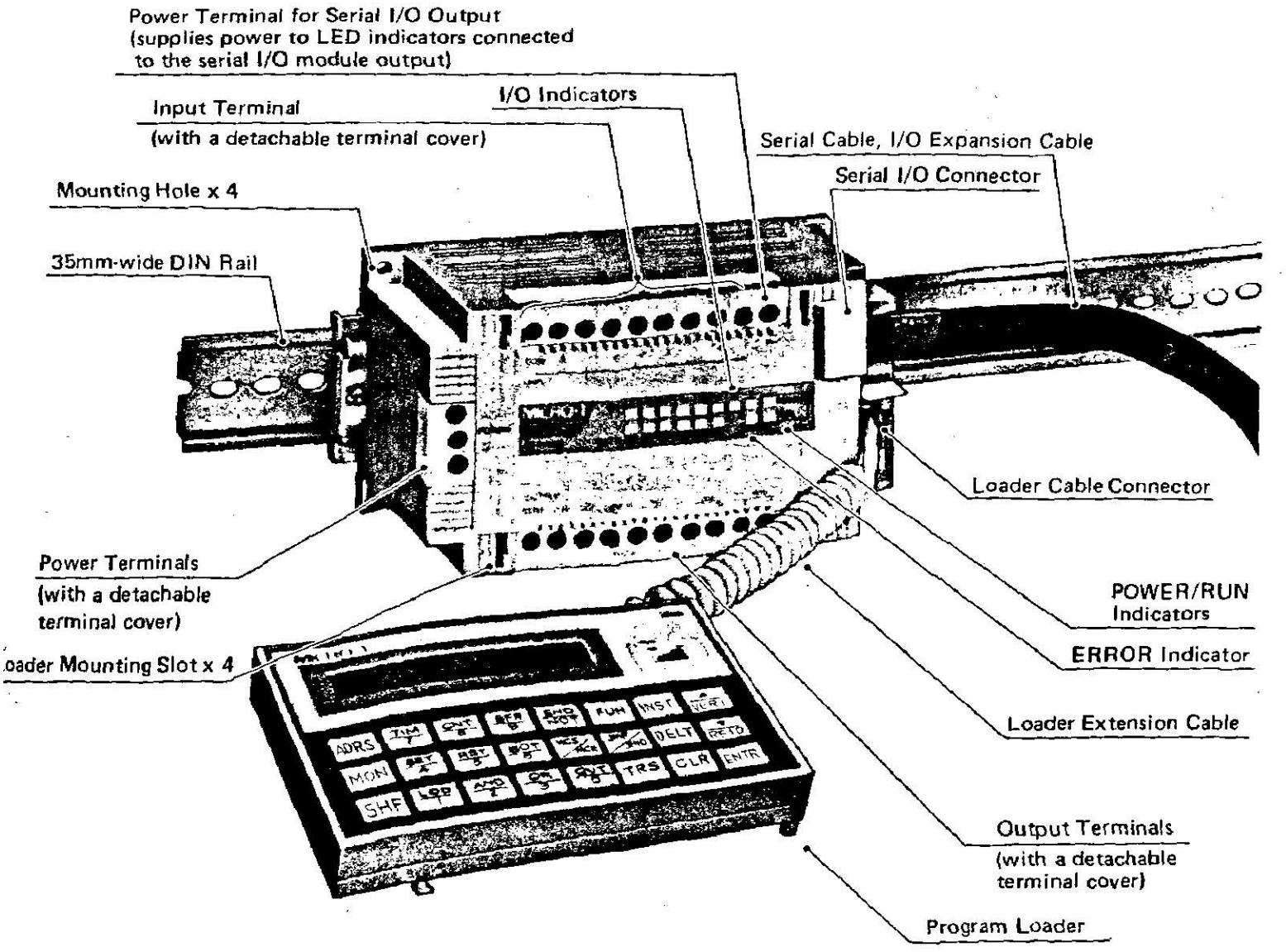
Built-in DC power supply.

The MICRO-1 base unit has a built-in power supply for inputs, eliminating the need for an external power supply and saving wiring time and cost.

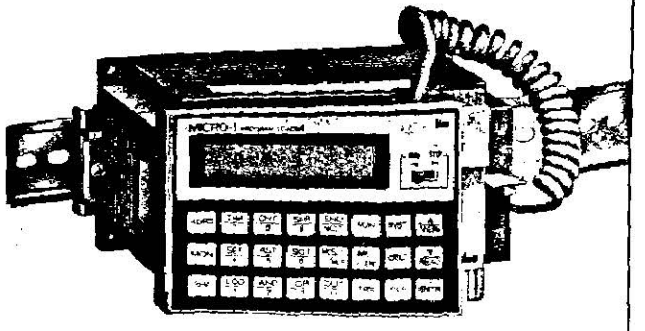
Reduced wiring by Serial I/O Module

- Serial I/O module allows for expansion of 8 inputs and 8 outputs using one cable, saving wiring and total cost.
- Using the serial I/O module allows external control switches and indicators to be connected with only one cable.
- External display units can be connected to the serial I/O module to display timer or counter current values. (Mother boards for mounting the serial I/O module and IDEC's DD33/DD48 series display units are available optionally.)
- Using the key matrix function with 8 inputs and 8 outputs wired in matrix allows to accept a maximum of 64 input signals. This function enables the MICRO-1 to control machines with many input points. (See Serial I/O Module Users Manual EM230.)

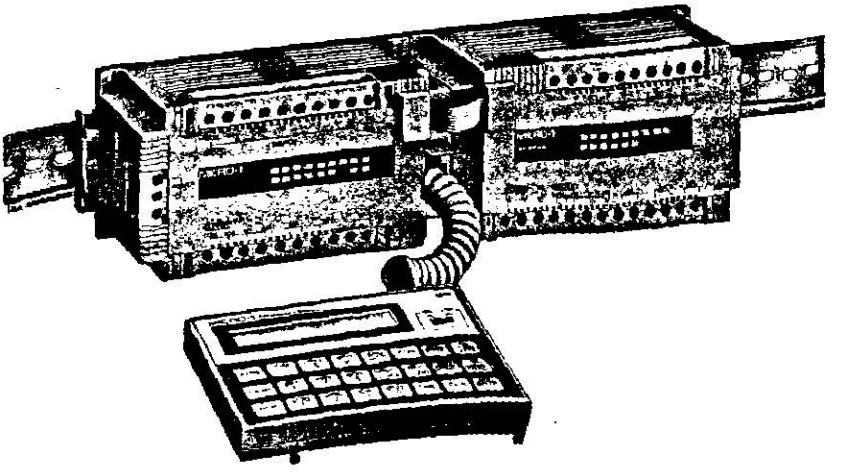
PART DESCRIPTION



Base Unit with Program Loader mounted on it.



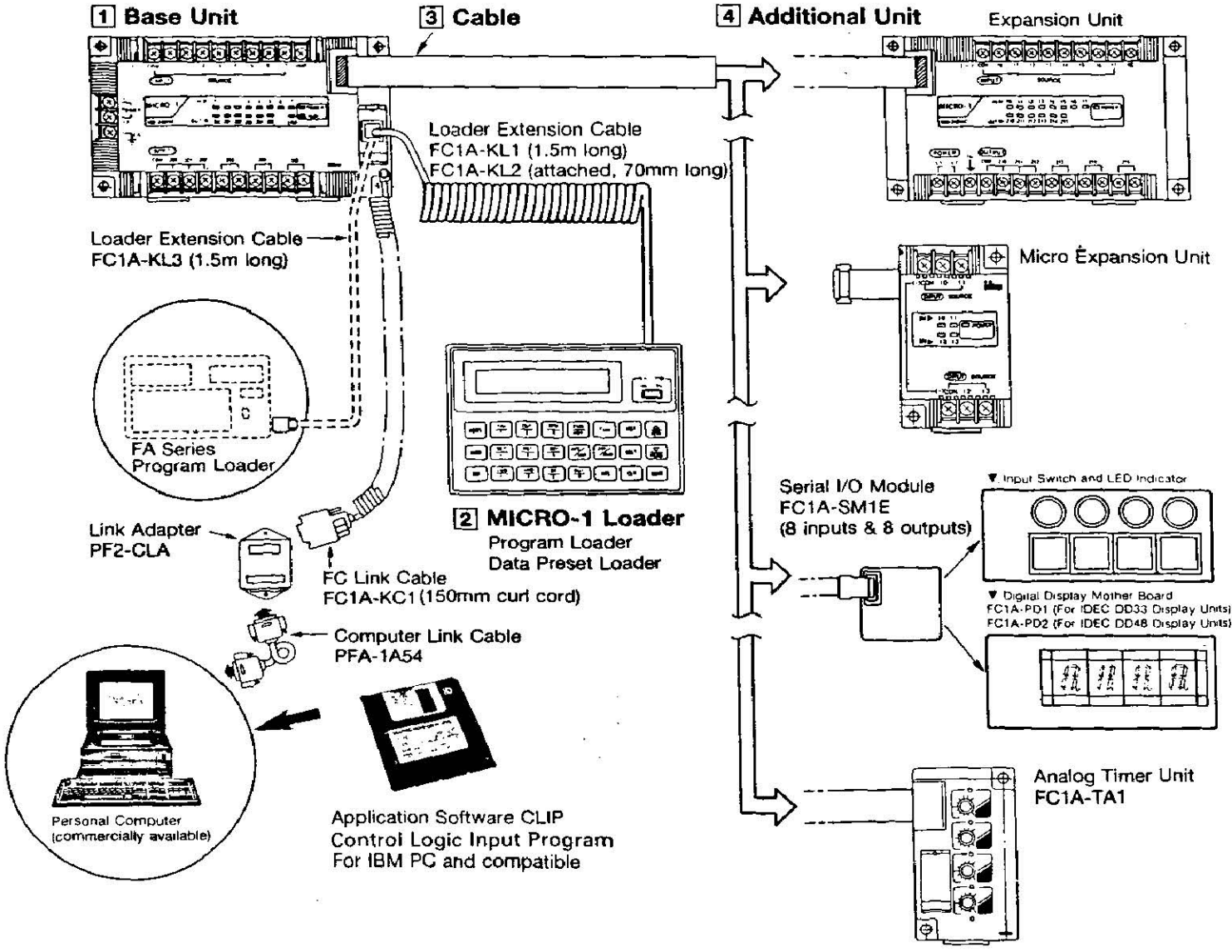
Base Unit and Expansion Unit mounted side by side.



SYSTEM CONFIGURATION

1. Basic System

The MICRO-1 base unit can be connected to an expansion unit, serial I/O module or analog timer unit. In addition, either program loader or data preset loader can be connected to the base unit.



1 Base Unit

- AC Type (100-240V AC)

Source-input relay-output type
Sink-input relay-output type
Source-input sink-output type
Sink-input source-output type

- DC Type (24 or 12V DC)

Source-input relay-output type
Sink-input relay-output type
Source-input sink-output type
Sink-input source-output type

2 MICRO-1 Loader

Program Loader
Data Preset Loader

- Standard type
- Multi-function type

Note: A loader extension cable FC1A-KL2 (70mm curl cord) is attached to each program loader or data preset loader.

3 Cable

I/O Expansion Cable
40mm, 500mm, 750mm, 1m long
For use on expansion units or analog timer units.
A 40mm I/O expansion cable FC1A-KE1 is attached to each expansion unit or analog timer unit.

Micro Expansion Cable
500mm, 1m long
For use on a micro expansion unit when mounted away from the base unit.

Serial Cable
1m, 2m, 3m long
For use on a serial I/O module.

4 Additional Unit

Expansion Unit

- AC Type (100-240V AC)

Source-input relay-output type
Sink-input relay-output type
Source-input sink-output type
Sink-input source-output type

- DC Type (24 or 12V DC)

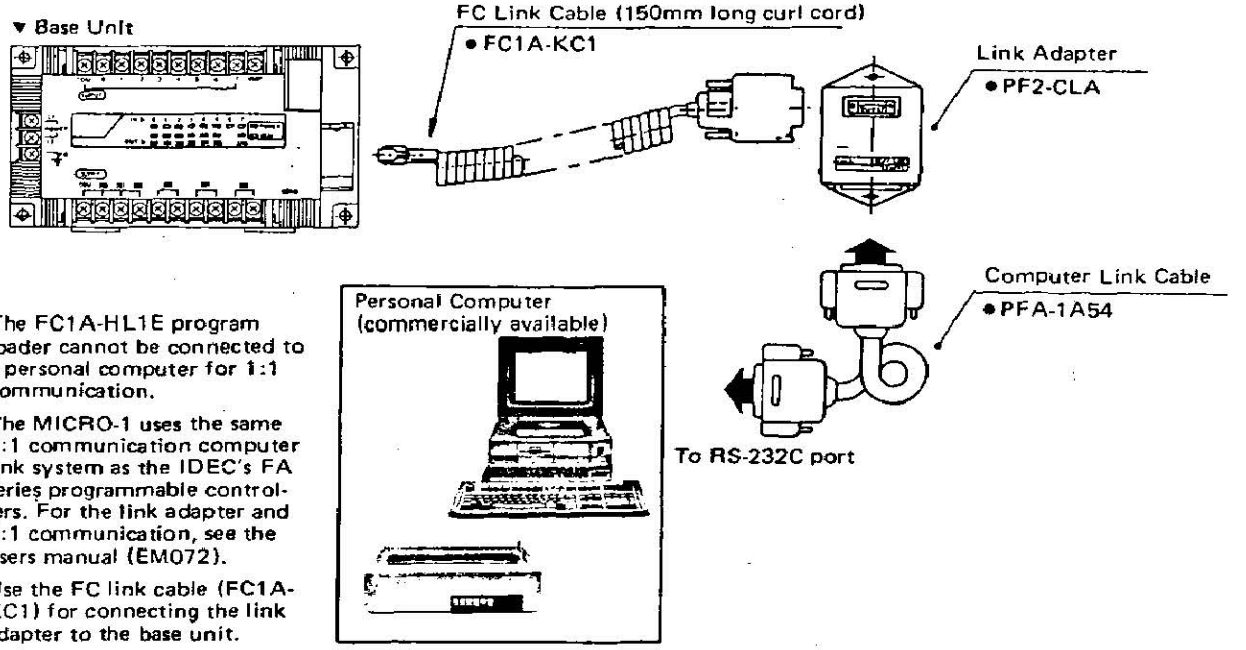
Source-input relay-output type
Sink-input relay-output type
Source-input sink-output type
Sink-input source-output type

Micro Expansion Unit
4-point source input
4-point sink input
3-point relay output
2-point source-input 2-point sink-output
2-point sink-input 2-point source-output

Serial I/O Module

Analog Timer Unit

2. 1:1 Communication Computer Link System

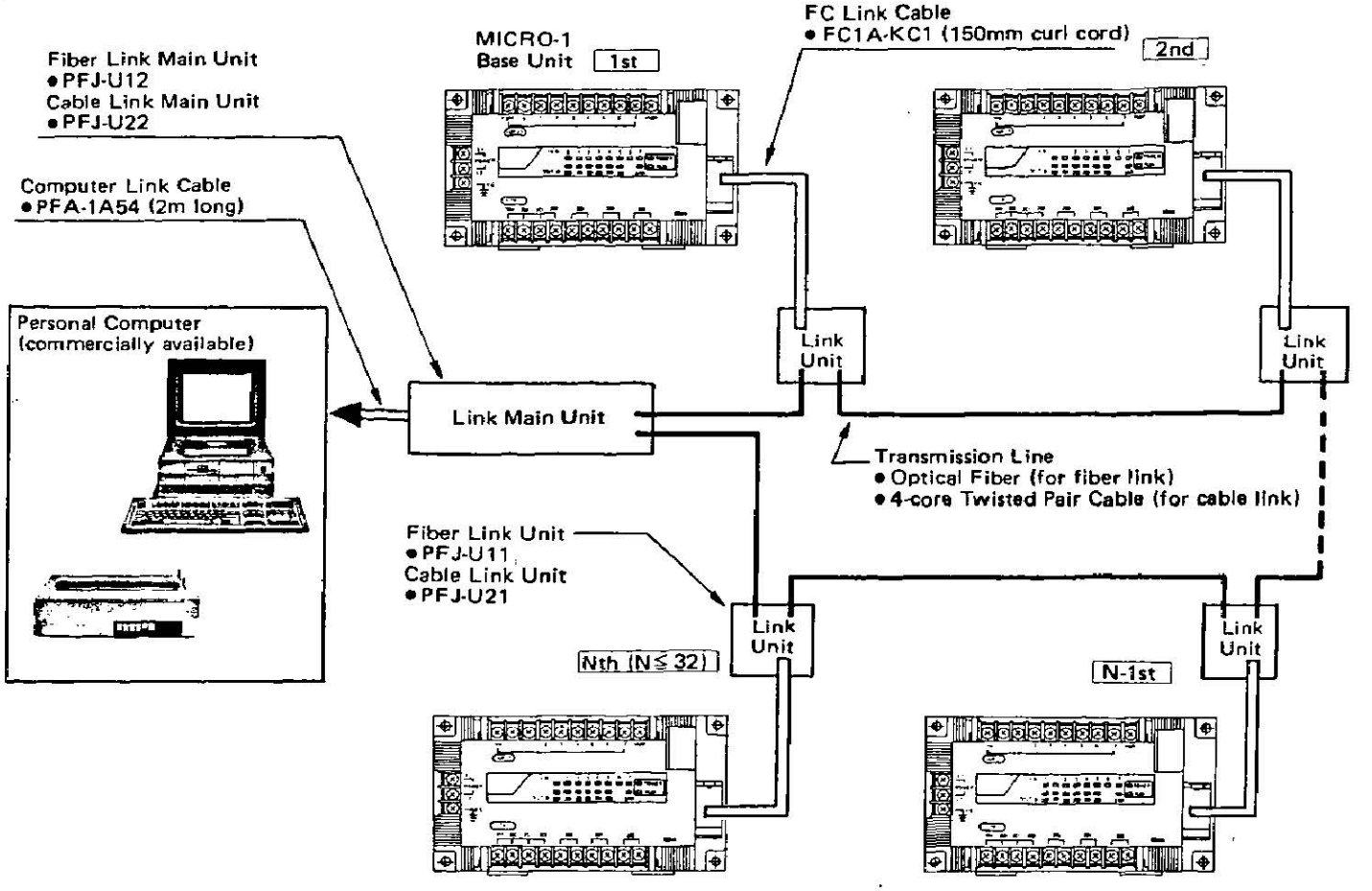


Note 1: The FC1A-HL1E program loader cannot be connected to a personal computer for 1:1 communication.

Note 2: The MICRO-1 uses the same 1:1 communication computer link system as the IDEC's FA series programmable controllers. For the link adapter and 1:1 communication, see the users manual (EM072).

Note 3: Use the FC link cable (FC1A-KC1) for connecting the link adapter to the base unit.

3. 1:N Communication Computer Link System



Note 1: The MICRO-1 uses the same 1:N communication computer link system as the IDEC's FA series programmable controllers. For the link units, link main units and 1:N communication, see the users manual (EM071).

Note 2: Use the FC link cable (FC1A-KC1) for connecting the link adapter to the base unit.

SPECIFICATIONS

• General Specifications

Power Voltage	100 to 240V AC, 50/60Hz 24V DC, 12V DC
Power Voltage Range	85 to 264V AC 19.2 to 28.8V DC, 8.4 to 14.4V DC
Power Consumption (Approx.)	AC Type (Base/Expansion Unit): 21VA 24V DC Type (Base Unit): 8W 24V DC Type (Expansion Unit): 6W 12V DC Type (Base/Expansion Unit): 10W Program Loader: 1W
Allowable Momentary Power Failure	50 msec maximum (at the maximum load)
Dielectric Strength	Between power or I/O terminal and ground: 1,500V AC, 1 minute
Insulation Resistance	Between power or I/O terminal and ground: 10MΩ (500V DC megger)
Operating Temperature	0 to +55°C
Storage Temperature	−20 to +70°C
Operating Humidity	45 to 85% RH (no condensation)
Vibration Resistance	5 to 55Hz, 6G, 2 hours each in 3 axes
Shock Resistance	30G, 3 shocks each in 3 axes
Noise Resistance	Between power or I/O terminal and ground: AC type: ±1.3kV, 1μsec 24V DC type: ±1.0kV, 1μsec 12V DC type: ±500V, 1μsec
Operating Atmosphere	Free from corrosive gases
Grounding	Grounding resistance 100Ω maximum
Mounting Style	Wall and 35mm-wide DIN rail
Weight (Approx.)	Base Unit: 450g (Relay output) 410g (Transistor output) Expansion Unit: 410g (Relay output) 370g (Transistor output) Program Loader: 100g
Dimensions	Base/Expansion Unit: 140W × 80H × 74D mm Program Loader: 110W × 80H × 20D mm

• Function Specifications

Control System	Stored program system
Programming Method	Logic symbol
Instruction Words	15 basic instructions 2 FUN instructions
Program Capacity	600 steps
Memory	EEPROM (built in the base unit)
Scan Time	8 μsec/basic instruction (ave.)
Input	8 points (Expansion: 8, 4 or 2 points)
Output	6 points (Expansion: 6, 3 or 2 points)
Internal Relay	160 points (All points can be maintained.)
Special Internal Relay	96 points
Timer	80 points, subtracting (0 to 999.9 sec)
Counter	45 points, adding (0 to 9999) (All points can be maintained.)
Reversible Counter	2 points (maintained)
Single Output	96 points
Shift Register	128 points (All points can be maintained.)
Computer Link	Via the RS232C interface unit
Power Failure Protection	Internal relay, shift register, counter, reversible counter (backed up by a super capacitor for approx. 3 days at 25°C)
Self-Diagnostic Function	CPU error (WDT), CRC error, check sum error, communication error
Automatic Start Function	Operation starts when power is turned on.
Catch Input	1 point, 0.5-msec pulse (Input No. 0)
External Control	Start/stop using RUN/STOP switch on the program loader
Compatibility with FA series PLC	Program loaders are interchangeable using special cables.

• Program Loader Specifications

Display	LCD, 16 characters in one line
Program Key	24-key membrane switch
Control Key	RUN/STOP switch
Power Supply	Supplied from the base unit
Connection	Using the loader extension cable (A 70mm-long curl cord is attached to the program loader)
Mounting	Hooked onto the base unit
Power Failure Protection	CMOS-RAM memory is backed up by a capacitor. Backup duration: Approx. 3 minutes (at 25°C)
Programming for FA series PLC	Possible by using a loader extension cable (FC1A-KL4) within the functions of this program loader

• Input Specifications (Base/Expansion Units)

No. of Inputs		8 points (M3 screw terminal)
Input Signal	Source Type	NPN open collector transistor input No-voltage mechanical contact input
	Sink Type	PNP open collector transistor input No-voltage mechanical contact input
Rated Voltage		24V DC [12V DC]
Isolation Method		Photocoupler
Input Current		5mA [8mA]
Input Impedance		4.3kΩ [1.2kΩ]
Turn ON Time		7 msec maximum
Turn OFF Time		11 msec maximum
Must Turn ON Current		4mA minimum [3mA minimum]
Must Turn OFF Current		1mA maximum [1.5mA maximum]

• Output Specifications (Base/Expansion Units)

(Relay Output Type)

No. of Outputs	6 points (M3 screw terminal)
Output Device	Electromechanical relay contact
Contact Configuration	Independent 1NO contact: 3 points Common 1NO contact: 3 points
Switching Capacity	Independent contact: 220V AC, 2A Common contact: 220V AC, 2A total (resistive load)
	220V AC, 2A (resistive, inductive*) 30V DC, 2A (resistive, inductive**)
Minimum Applicable Load	5V DC, 1mA (reference value)
Contact Resistance	30 mΩ maximum (initial value)
Mechanical Life (without load)	20,000,000 operations (at 1,800 operations/hour)
Electrical Life (rated load)	100,000 operations (at 1,800 operations/hour)

*cos ϕ = 0.4, **L/R = 7 msec

(Transistor Output Type)

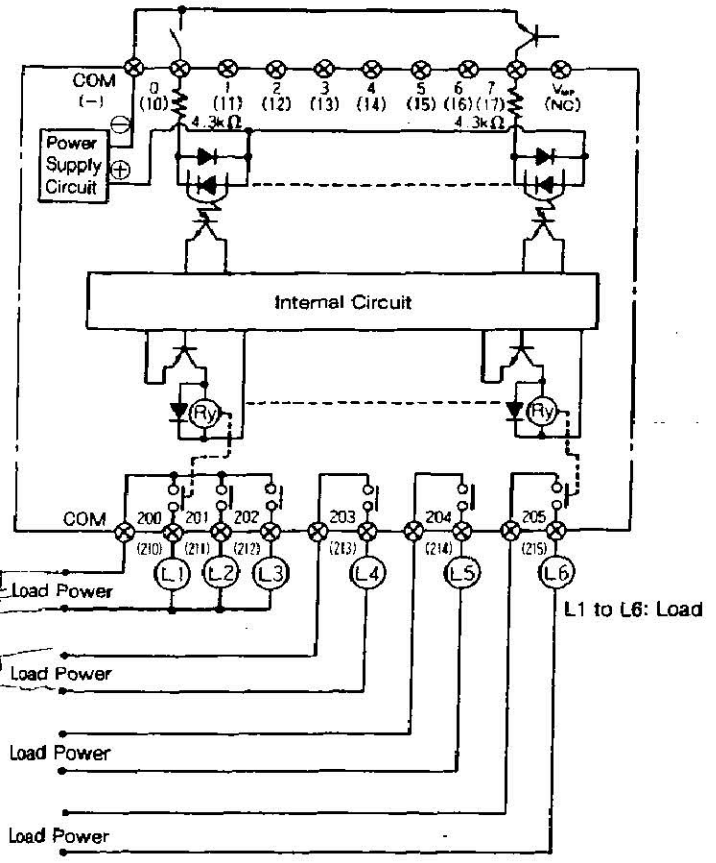
No. of Outputs		6 points (M3 screw terminal)
Output Device	Sink Output	NPN transistor: 6 points/common
	Source Output	PNP transistor: 6 points/common
Isolation Method		Photocoupler
Rated Load Voltage		12 to 24V DC ±10%
Maximum Load Current		0.4A/circuit
Rush Current		5A maximum [40A maximum]
Leakage Current		100μA maximum
Turn ON Time		1 msec maximum
Turn OFF Time		1 msec maximum
ON Voltage	Sink Output	1.5V maximum
	Source Output	Load voltage −1.5V minimum
External Current Draw		12 to 24V DC, 40mA

Note: Values in [ ] represent the 12V DC type base and expansion units.

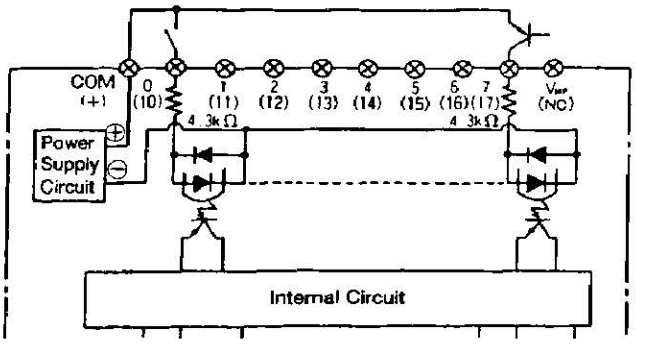
Internal Circuit and Wiring Diagram

Relay Output Type (Base/Expansion Units)

• Source Input Type



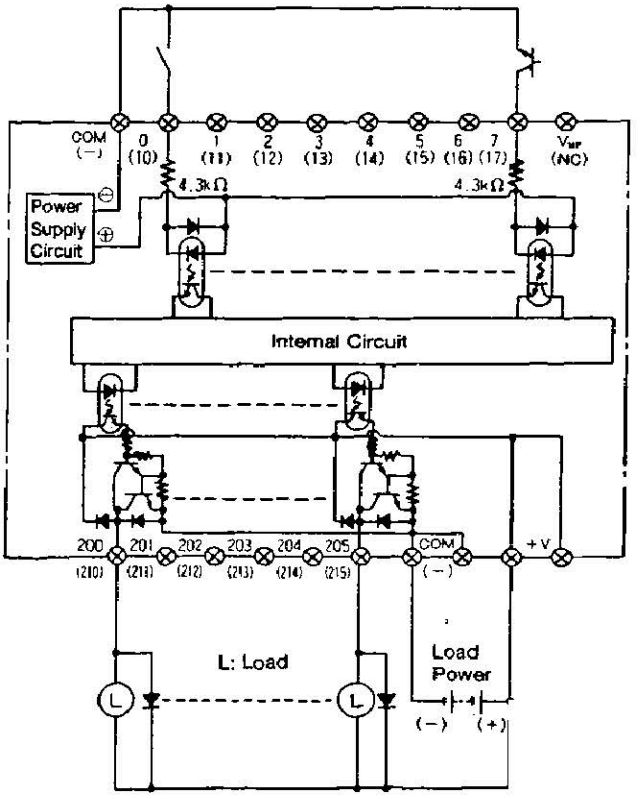
• Sink Input Type



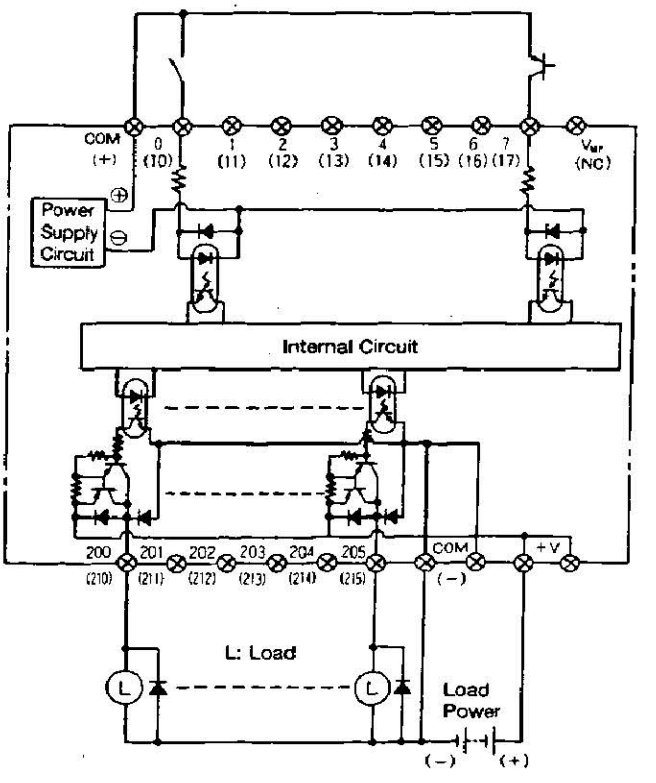
Note 1: Terminal numbers in ( ) represent an expansion unit.
Note 2: The sink input type has the same relay output as the source input type.
Note 3: The input impedance of the 12V DC type base and expansion units is 1.2 kΩ.

Transistor Output Type (Base/Expansion Units)

• Source-Input Sink-Output Type



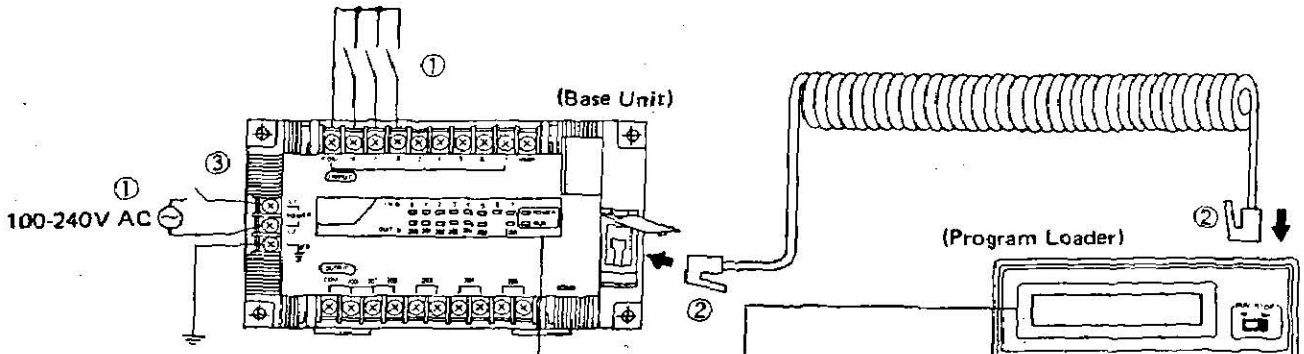
• Sink-Input Source-Output Type



Note 1: Terminal numbers in ( ) represent an expansion unit.
Note 2: The input impedance of the 12V DC type base and expansion units is 1.2 kΩ.

SIMPLE OPERATION EXAMPLE

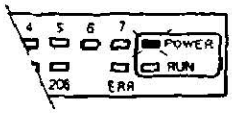
This chapter describes a simple operation example.



① **Connect power supply and input switches to the base unit.**
This example shows wiring for AC type base unit (source input type).

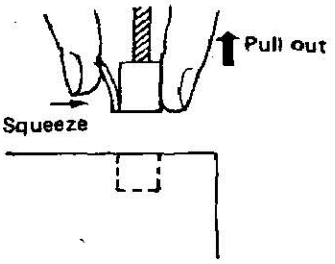
② **Connect the program loader to the base unit using the attached program loader extension cable.**

③ **Supply power to the base unit.**
- The POWER indicator on the base unit goes on.



Plugging The Connector

- Plug the loader extension cable connector into the receptacle in the program loader until the latch is locked.
- To remove the connector, squeeze the latch and pull the connector out.



- "POWER ON" is displayed on the program loader.

(Display)

```
POWER   ON
```

↓ Approx. 5 seconds later

```
PC  ---  STOP
```
..... Indicates the MICRO-1 is in halt.

"PC -- RUN" is displayed when the MICRO-1 is in operation.

Approx. 7 seconds later

```
0  END
```
..... Program is displayed.

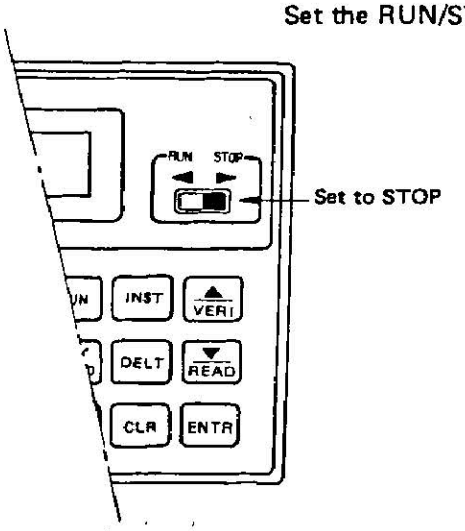
(The display massage varies with the program.)

④ Start programming.

(1) Stop MICRO-1 operation.

Set the RUN/STOP switch on the program loader to STOP.

If the switch is at RUN, the display changes to "PC — STOP", and 7 minutes later, the program is displayed.



(2) Delete all programs from the program loader memory.

Key Operation DELT END ENTR

(Display)

0 END

This example performs the operation of Fig. 1 time chart.

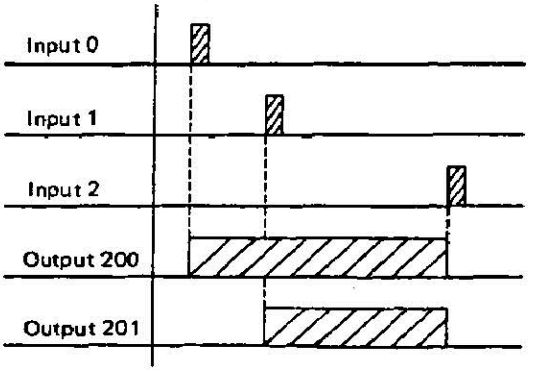


Fig. 1 Time Chart

Operation

- When Input 0 is turned ON, Output 200 is self-maintained.
- When Input 1 is turned ON, Output 201 is self-maintained.
- When Input 2 is turned ON, Outputs 200 and 201 are turned OFF.

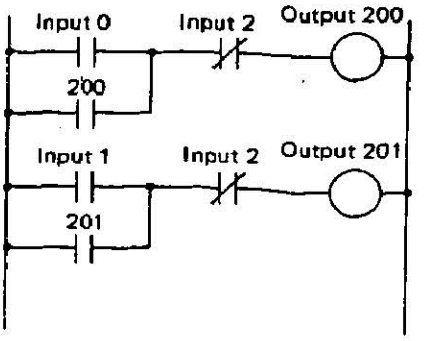


Fig. 2 Relay Diagram

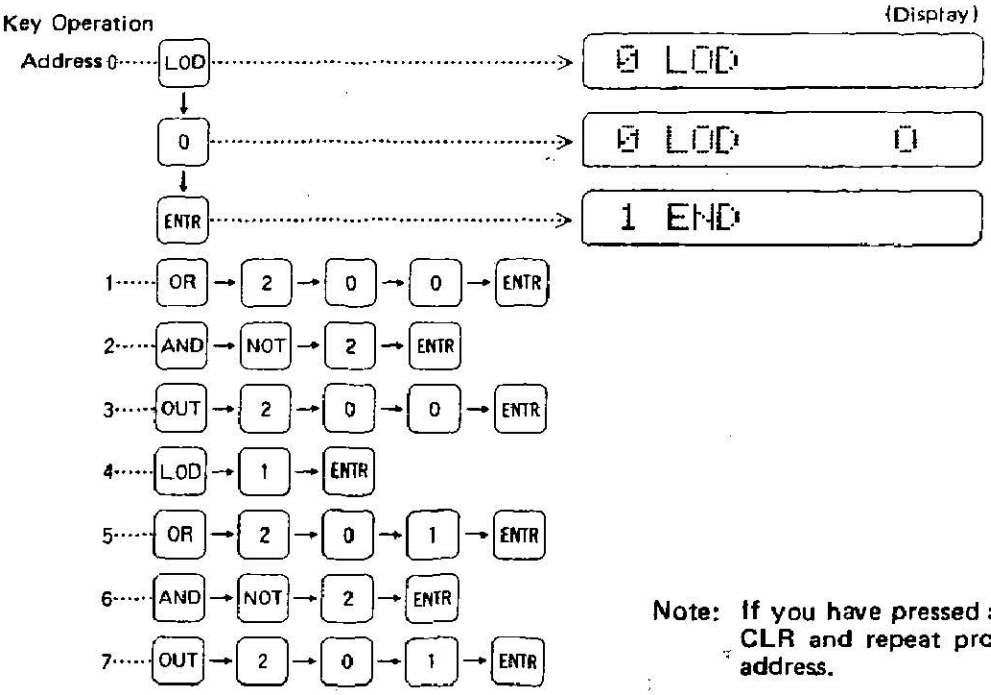
Address	Instruction Word	Data
0	LOD	0
1	OR	200
2	AND NOT	2
3	OUT	200
4	LOD	1
5	OR	201
6	AND NOT	2
7	OUT	201
8	END	

Fig. 3 Program List

Fig. 2 relay diagram is converted to Fig. 3 program list.

Fig. 3 program list is entered using the program loader as follows.

(3) Enter the sample program using the keys on the program loader.



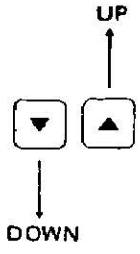
Note: If you have pressed a wrong key, press CLR and repeat programming for the address.

⑤ Check the program.

When you have finished programming, check the program.

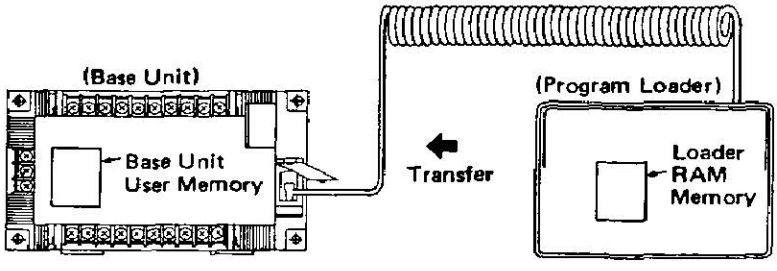
Press the ▲ key until address 0 is displayed.

Press the ▼ key and verify the program at each step with Fig. 3 program list.



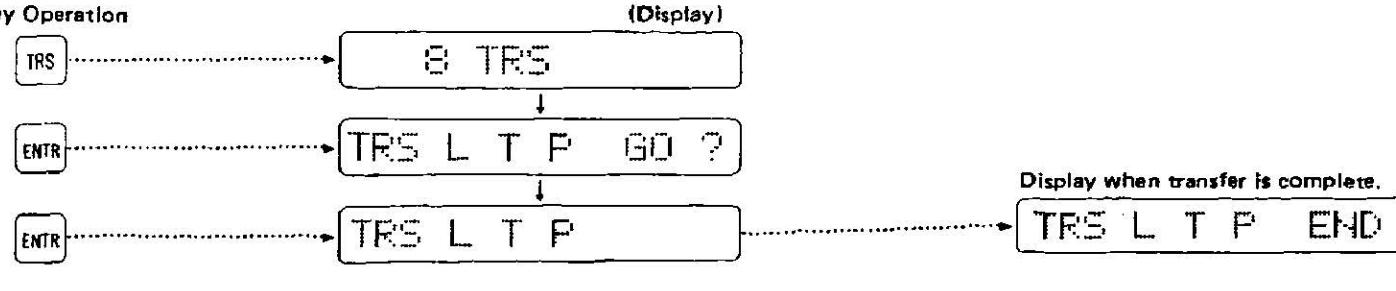
Address	Instruction Word	Data
0	LOD	0
1	OR	200
2	AND-NOT	2
3	OUT	200
4	LOD	1
5	OR	201
6	AND-NOT	2
7	OUT	201
8	END	

⑥ Transfer the program from the program loader to the base unit.



The entered program is stored in the program load memory. The program must be transferred to th base unit memory to operate the MICRO-1.

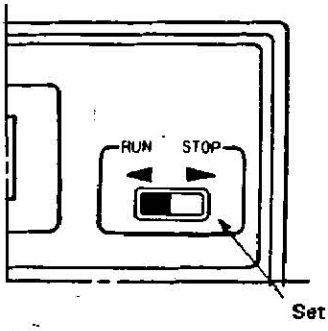
Program Transfer Operation



⑦ Start MICRO-1 operation.

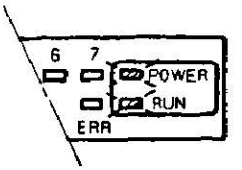
(1) Set the RUN/STOP switch on the program loader to RUN.

(Program Loader)



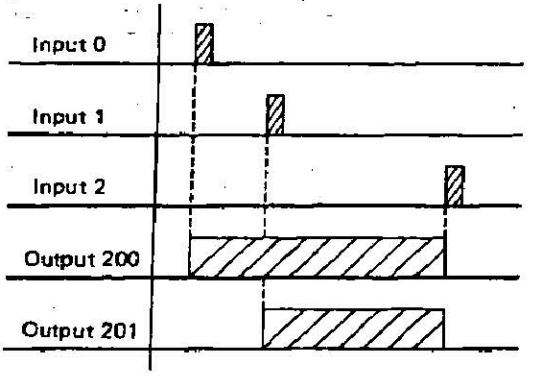
Set to RUN

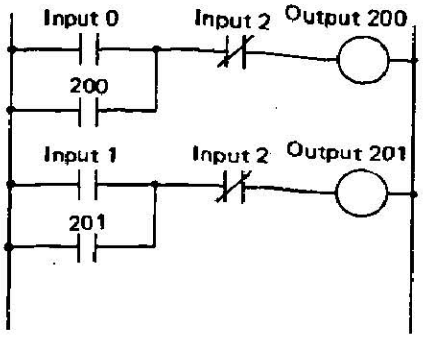
(Base Unit)



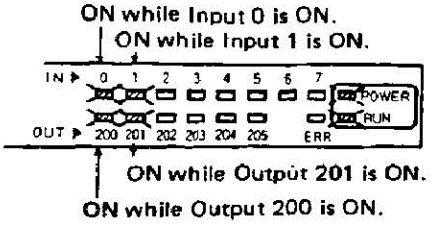
(Display)

(2) Make sure that the RUN indicator is ON and turn inputs ON according to the Fig. 1 time chart to see if the MICRO-1 operates as programmed.





- When Input 0 is turned ON (Indicator 0 goes ON), Output 200 goes ON (Indicator 200 goes ON). After Input 0 is turned OFF, Output 200 remains ON.
- When Input 1 is turned ON (Indicator 1 goes ON), Output 201 goes ON (Indicator 201 goes ON). After Input 1 is turned OFF, Output 201 remains ON.
- When Input 2 is turned ON (Indicator 2 goes ON), Outputs 200 and 201 go OFF (Indicators 200 and 201 go OFF).



⑧ Monitor input and output statuses.

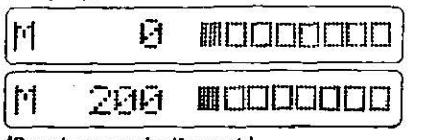
Input and output statuses can be monitored on the program loader.

(1) Monitor Inputs 0 to 7 (8 points). MON → 0 → READ

(2) Monitor Outputs 200 to 205 (6 points). MON → 2 → 0 → 0 → READ

(3) End monitoring. CLR

(Display)



(8 points are indicated.)

■ indicates ON

Remarks

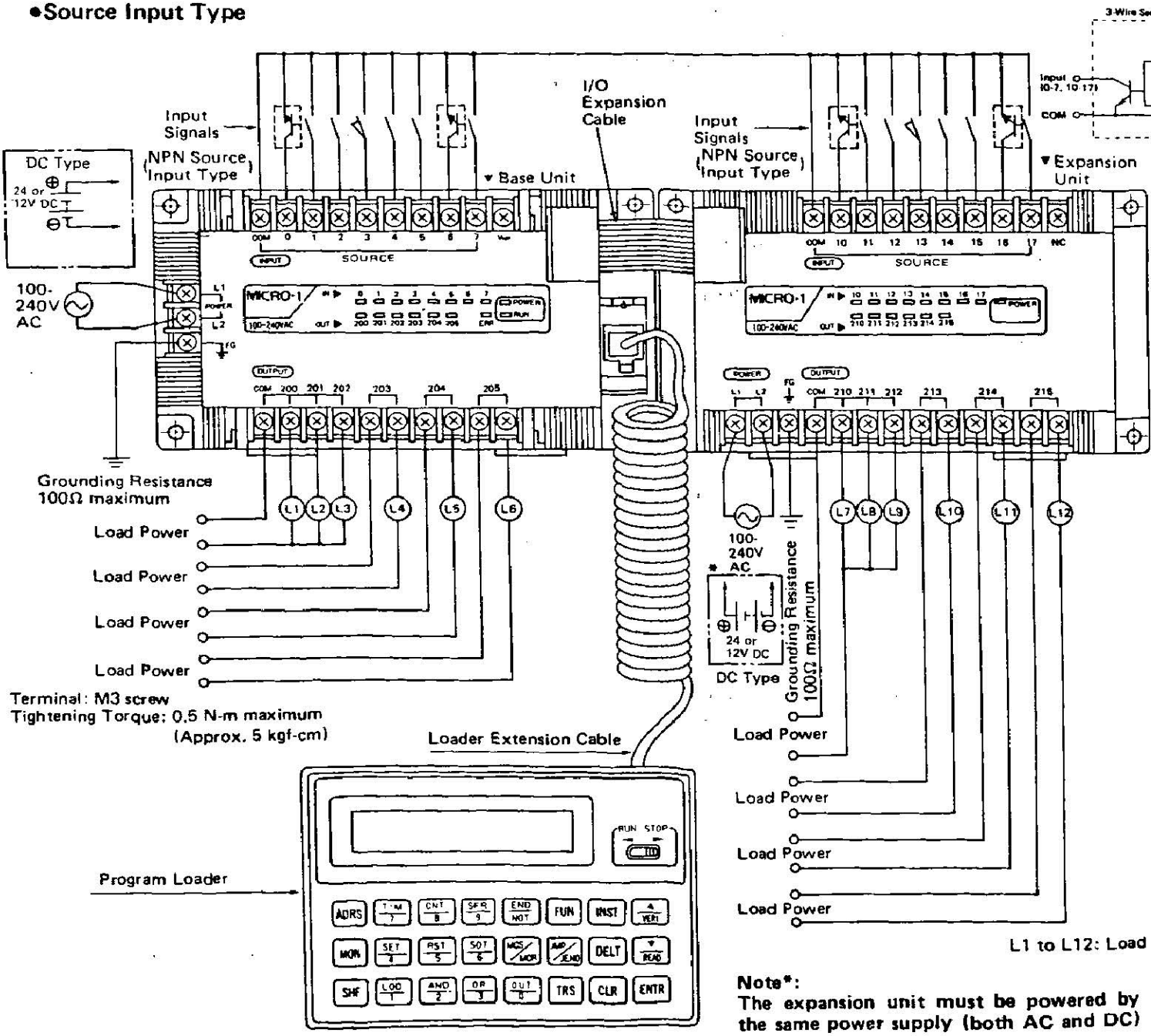
1. For programming procedures and notes, see page 37.
2. RUN/STOP response time and program transfer time
   (1) From RUN to STOP
   After the base unit operation is stopped by the program loader, the program loader displays "PC-STOP" in 2 seconds. After 7 seconds, the program is displayed.
   (2) From STOP to RUN
   After the base unit operation is started by the program loader, the program loader displays "PC-RUN" in 1.5 seconds. After 7 seconds, the program is displayed.
   (3) •Program transfer from program loader to base unit: Approx. 4 sec
   •Program transfer from base unit to program loader: Approx. 3 sec
   •RUN after turning power ON: Approx. 5 sec

For details, see START/STOP OPERATION on page 31 and Transfer Program on page 57.

I/O WIRING

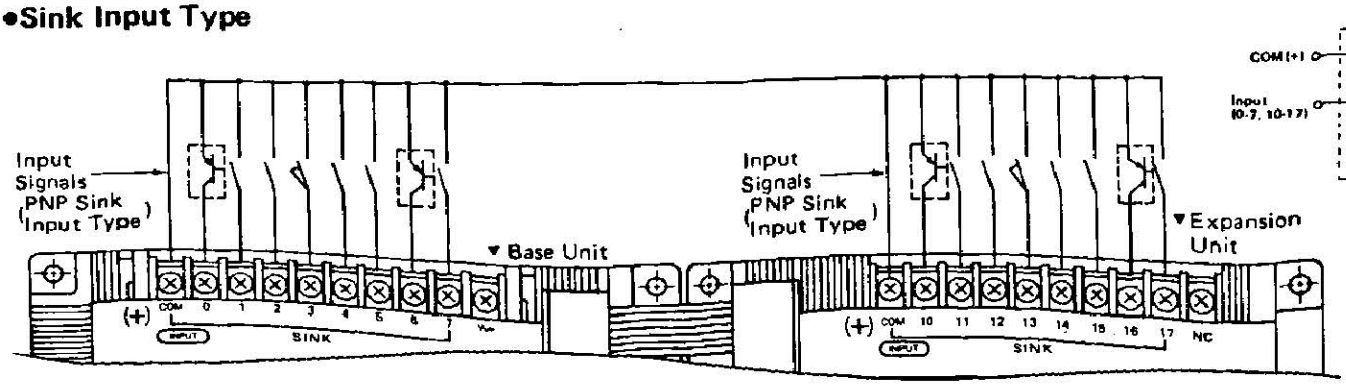
1. Relay Output Type (Base/Expansion Units)

•Source Input Type



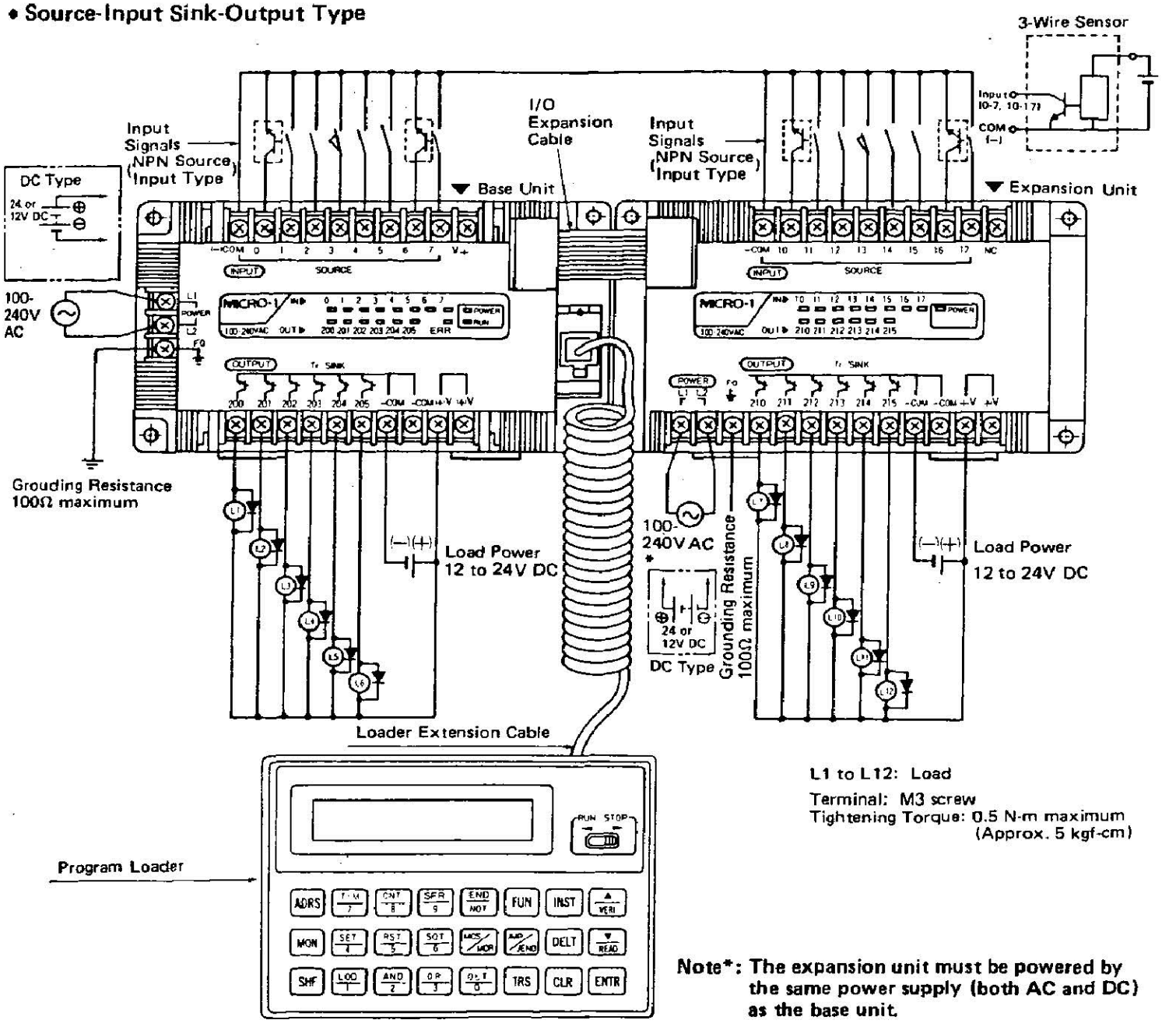
Note*:
The expansion unit must be powered by the same power supply (both AC and DC) as the base unit.

•Sink Input Type



2. Transistor Output Type (Base/Expansion Units)

• Source-Input Sink-Output Type



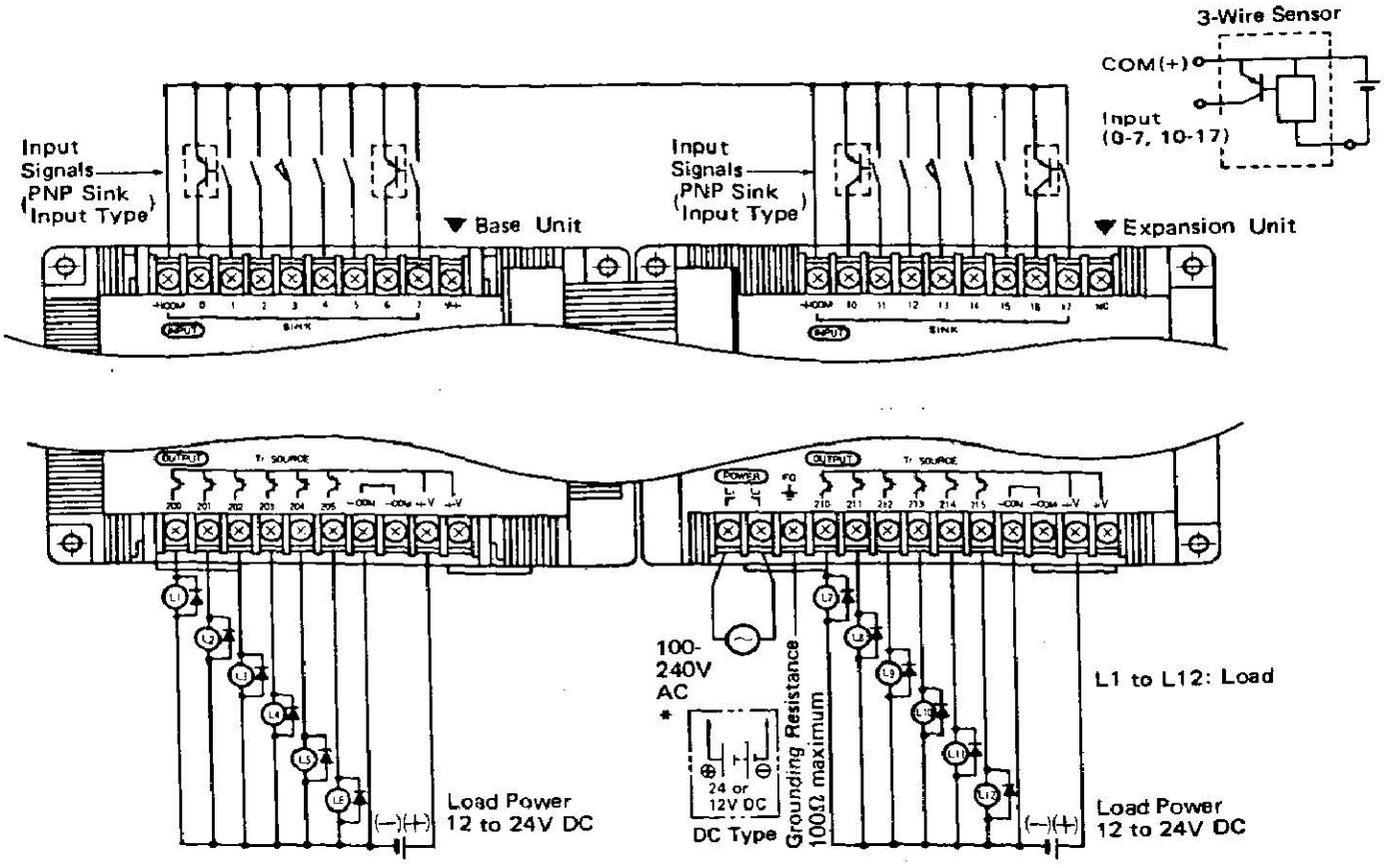
L1 to L12: Load

Terminal: M3 screw

Tightening Torque: 0.5 N-m maximum (Approx. 5 kgf-cm)

Note*: The expansion unit must be powered by the same power supply (both AC and DC) as the base unit.

• Sink-Input Source-Optput Type



Note*:
The expansion unit must be powered by the same power supply (both AC and DC) as the base unit.

ALLOCATION NUMBERS

Name	Allocation No.	No. of Points
Input	0-7, (10-17: when using expansion unit or serial I/O module)	8 (16)
Output	200-205, (210-215: when using expansion unit)*	6 (12)
	200-205, (210-217: when using serial I/O module)*	6 (14)
Internal Relay	400-407, 410-417, 420-427, 430-437, 440-447, 450-457, 460-467, 470-477, 480-487, 490-497, 500-507, 510-517, 520-527, 530-537, 540-547, 550-557, 560-567, 570-577, 580-587, 590-597	160 (can be maintained)
Special Internal Relay	600-607, 610-617, 620-627, 630-637, 640-647, 650-657, 660-667, 670-677, 680-687, 690-697, 700-707, 710-717	96
Counter	0-44	45 (can be maintained)
Reversible Counter	45, 46	2 (can be maintained)
Timer	0-79	80
Single Output	0-95	96
Shift Register	0-127	128 (can be maintained)

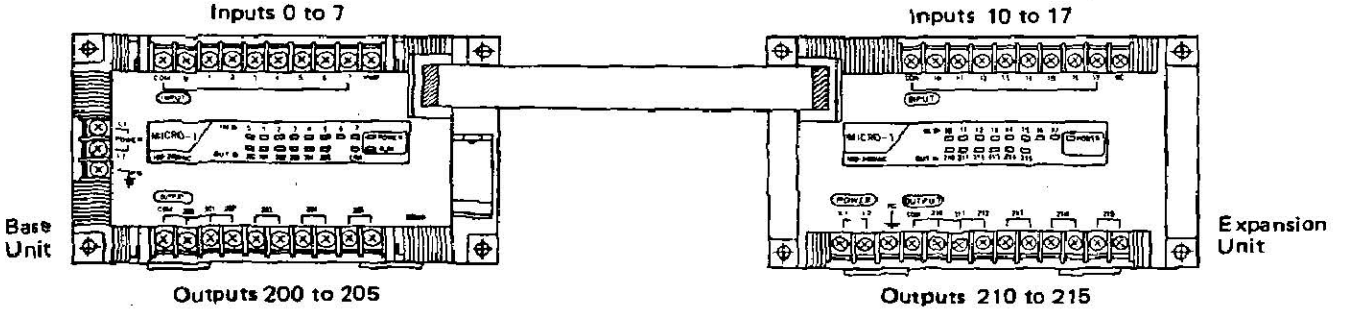
Note*: Outputs 206 and 207 cannot be used.

•Special Internal Relay

No.	Function	Remarks
600-677*	Setting key matrix input ON/OFF statuses	For readout only
680-687*	Key matrix scan output	For readout only
690	Setting catch input ON/OFF status	For readout only
691-697	Unassigned	
700	Unassigned	
701, 702	Start control	
703	All outputs OFF	
704	Initialize pulse (Turns ON for 1 scan when starting)	For readout only
705-712	Unassigned	
713	1-sec clock reset	
714	1-sec clock (Duty 1:1)	For readout only
715	100-msec clock (Duty 1:1)	For readout only
716	Timer/counter preset value changed	For readout only
717	In-operation output	For readout only

Note*: These special internal relays are available when using a serial I/O module.

Supplementary 1 Input and output numbers are allocated as shown below.



Supplementary 2

600-677 Setting Key Matrix Input ON/OFF Statuses

ON/OFF statuses of M x N (M = 1 to 8, N = 1 to 8) key matrix are set to special internal relays 600 to 677 (64 points maximum).
For details, see Serial I/O Module Users Manual EM230.

680-687 Key Matrix Scan Output

When FUN34 is set, special internal relays 680 through 687 are scanned 8 times repeatedly in one cycle, generating outputs. Allocating these scan outputs to real outputs can constitute a key matrix of inputs and outputs.
For details, see Serial I/O Module Users Manual EM230.

690 Setting Catch Input ON/OFF Statuses

While Input 0 is scanned, the catch input status is set to special internal relay 690.
For details, see page 33.

701, 702 Start Control

The MICRO-1 operation can be started (RUN) or stopped (STOP) by turning special internal relays 701 and 702 ON or OFF.

701	702	MICRO-1 Status
OFF	OFF	RUN
ON	OFF	STOP
OFF	ON	RUN
ON	ON	RUN

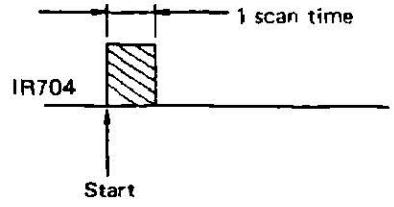
The MICRO-1 operation is started by turning special internal relay 701 OFF with the RUN/STOP switch on the program loader set to RUN, and is stopped by turning 701 ON and 702 OFF with the RUN/STOP switch set to STOP.

703 All Outputs OFF

When IR703 is turned ON, all outputs 200-205 and 210-217 go OFF.
Self-holding circuits using outputs 200-205 and 210-217 also go OFF, and are not restored when IR703 is turned OFF. Internal relays and shift registers remain unchanged.

704 Initialize Pulse

When the MICRO-1 starts operation, IR704 goes ON for a period of one scan.

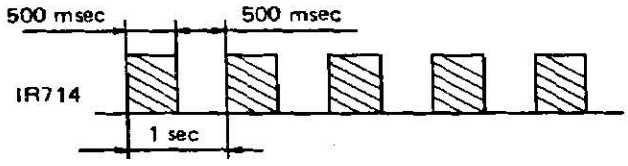


713 1-sec Clock Reset

While IR713 is ON, IR714 (1-sec clock) is placed in the reset mode.

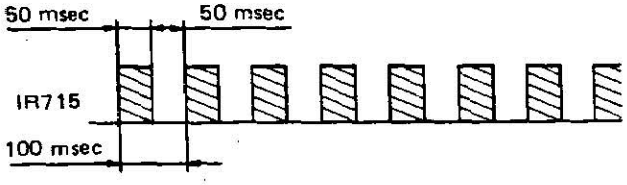
714 1-sec Clock

While IR713 is OFF, IR714 generates clock pulses oscillating at 500msec ON and 500msec OFF (duty ratio 1:1).



715 100-msec Clock

IR715 always generates clock pulses oscillating at 50msec ON and 50msec OFF.



716 Timer/Counter Preset Value Changed

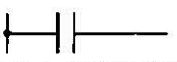
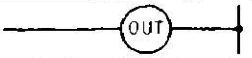
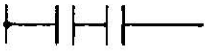
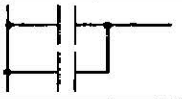
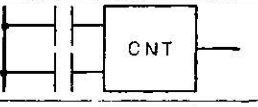
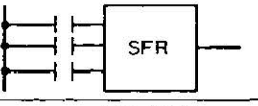
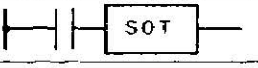
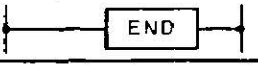
When timer/counter preset values in the MICRO-1 basic unit are changed using the program loader, IR716 goes ON.
IR716 is reset when the program is written into the user memory by pressing TRS, ENTR and ENTR keys.

717 In-operation Output

IR717 remains ON during operation.

INSTRUCTION WORDS

1. Basic Instruction Words

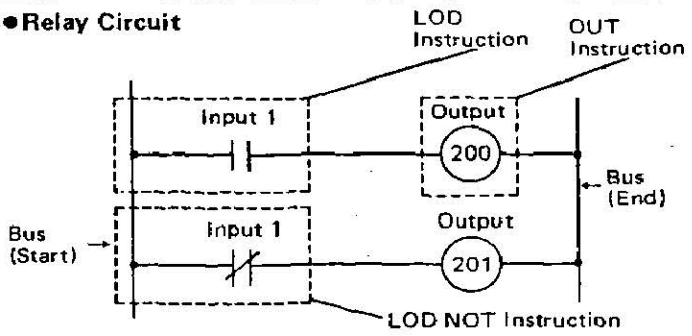
Symbol	Name	Relay Circuit Symbol	Function	Page
LOD	Load		Reads the I/O status after storing an intermediate result.	20
NOT	NOT		Inversion	20
OUT	Output		Output	20
AND	AND		Logical AND	21
OR	OR		Logical OR	21
TIM	Timer		Timer	24
CNT	Counter		Counter	25
SFR	Shift Register		Shift register	28
SOT	Single Output		Leading-edge differentiation	30
MCS	Master Control Set		Starts a master control.	31
MCR	Master Control Reset		Ends a master control.	31
SET	Set		Sets an output, internal relay or shift register.	31
RST	Reset		Resets an output, internal relay or shift register.	31
JMP	Jump		Jumps a designated program area.	32
JEND	Jump End		Ends a jump program.	32
END	End		Ends a program.	32

2. FUN (Function) Instruction

FUN No.	Relay Circuit Symbol	Instruction	Page
FUN100 to FUN146		Equivalent comparison instruction for the counter's counted values	27
FUN200 to FUN246		Equal to or greater than comparison instruction for the counter's counted values	27

LOD Load , NOT Not , OUT Output

●Relay Circuit



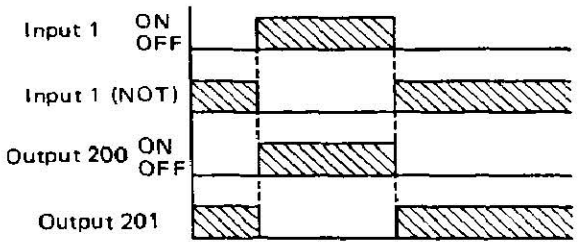
●Program List

Address	Instruction Word	Data
0	LOD	1
1	OUT	200
2	LOD NOT	1
3	OUT	201

●Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· OUT 2 0 0 ENTR
2 ····· LOD NOT 1 ENTR
3 ····· OUT 2 0 1 ENTR

●Time Chart



●Description

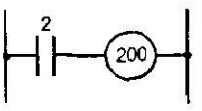
LOD The LOD instruction is used to program the beginning of a rung or section of a rung.

NOT The NOT instruction negates (inverts) the read input status.
This instruction is used as an auxiliary instruction for a LOD, AND or OR instruction.

OUT The OUT instruction is used to assign the output address and ends the rung.

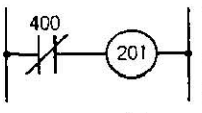
Examples

●Relay Circuit ●Program List ●Key Operation



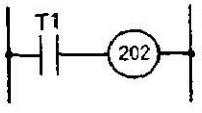
Instruction Word	Data
LOD	2
OUT	200

LOD 2 ENTR
OUT 2 0 0 ENTR



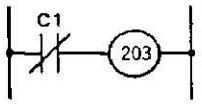
Instruction Word	Data
LOD NOT	400
OUT	201

LOD NOT 4 0 0 ENTR
OUT 2 0 1 ENTR



Instruction Word	Data
LOD T	1
OUT	202

LOD *SHF TIM 1 ENTR
OUT 2 0 2 ENTR



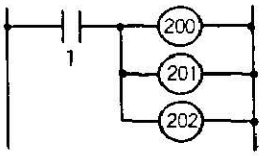
Instruction Word	Data
LOD NOT C	1
OUT	203

LOD NOT *SHF CNT 1 ENTR
OUT 2 0 3 ENTR

*The SHF key is used between two instruction keys pressed successively.
For example, LOD TIM, LOD CNT, and LOD SFR.

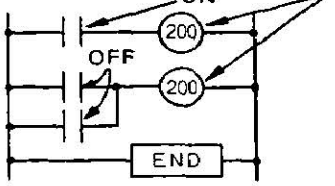
Note OUT **OUT Instruction**

1. Multiple programming of OUT instructions.
Any number of OUT instructions can be programmed in parallel.



LOD	1
OUT	200
OUT	201
OUT	202

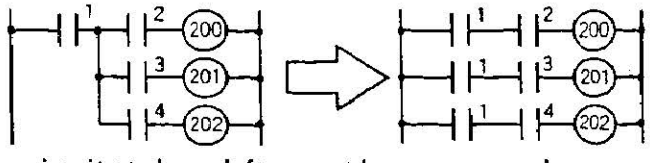
2. Notes for repeated programming of OUT instructions.
If more than one OUT instruction of the same number is programmed in one scan, the OUT instruction nearest to the END instruction is given priority and its status is outputted.



The same output number

In the example at left, Output 200 is OFF. If monitored in this state, Output 200 blinks.

3. The following circuit cannot be programmed.

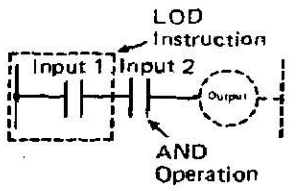


The circuit at above left cannot be programmed.
Use MCS/MCR instructions or modify the circuit as shown at above right.

AND

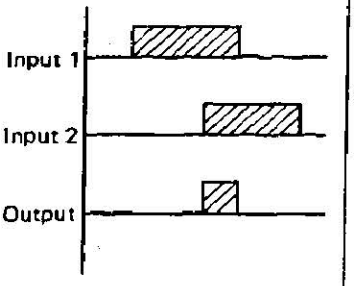
AND

●Relay Circuit



●The AND instruction is a logical product instruction used for programming a series contact circuit.

●Time Chart



●Program List

Address	Instruction Word	Data
0	LOD	1
1	AND	2

●Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· AND 2 ENTR

Example

AND program of a timer instruction

●Relay Circuit

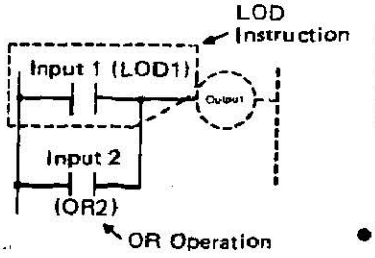
●Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· AND SHF TIM 1 ENTR

OR

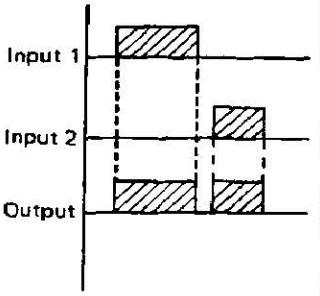
OR

●Relay Circuit



●The OR instruction is a logical sum instruction used for programming a parallel contact circuit.

●Time Chart



●Program List

Address	Instruction Word	Data
0	LOD	1
1	OR	2

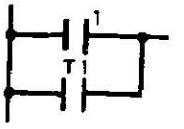
●Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· OR 2 ENTR

Example

OR program of a timer instruction

●Relay Circuit



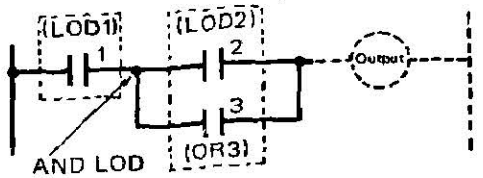
●Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· OR SHF TIM 1 ENTR

AND LOD — AND Load

(AND SHF LOD)

•Relay Circuit



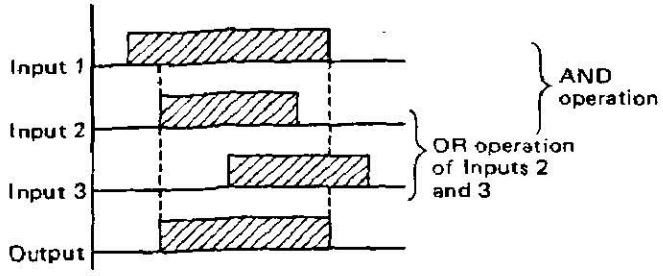
•Program List

Address	Instruction Word	Data
0	LOD	1
1	LOD	2
2	OR	3
3	AND·LOD	

•Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· LOD 2 ENTR
2 ····· OR 3 ENTR
3 ····· AND SHF LOD ENTR

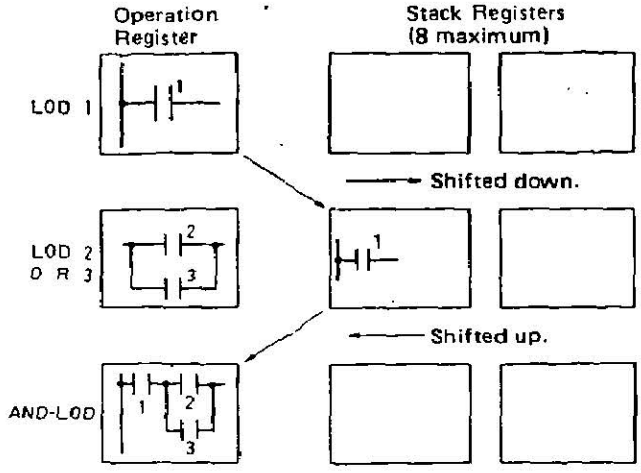
•Time Chart



•Circuits *starting* with LOD are connected *in series.*

Supplementary

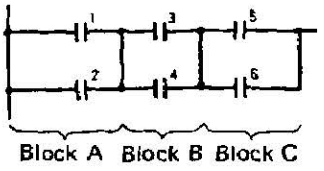
•Operation register and stack register statuses



The AND LOD instruction is used to connect circuits starting with a LOD instruction in series.

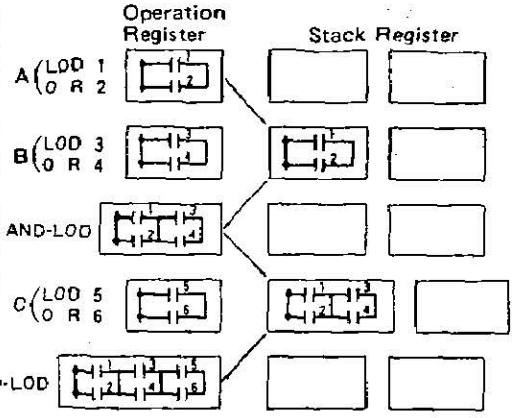
Example

For the following circuit example, the AND LOD instruction can be used in two ways.



•Program 1

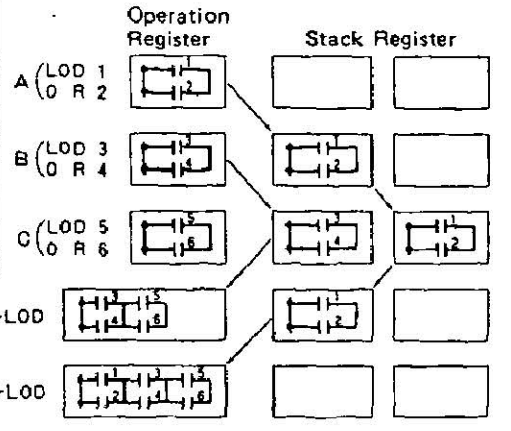
Instruction Word	Data
LOD	1
OR	2
LOD	3
OR	4
AND·LOD	
LOD	5
OR	6
AND·LOD	



Programs (Blocks A and B) stored respectively by LOD1 and LOD3 are read by the AND LOD instruction, thus forming a circuit connected in series.
Then, Block C starting with LOD5 is programmed, and the Block A/B circuits are connected in series with the Block C circuit by the AND LOD instruction.

•Program 2

Instruction Word	Data
LOD	1
OR	2
LOD	3
OR	4
LOD	5
OR	6
AND·LOD	
AND·LOD	



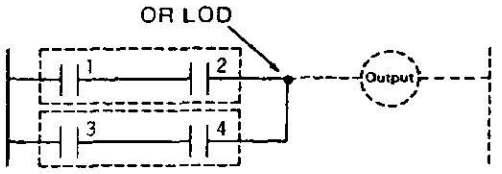
After Blocks A, B and C are stored in sequence, the AND LOD *instructions are used continuously two times, and* the circuits of Blocks A, B and C are connected in series sequentially.
In this case, note that the sequence of the stored circuits and the number of read operations. The relation between the LOD instructions used and the number of AND LOD instructions is as follows.

The number of AND LOD instructions
= The number of LOD instructions − 1

OR LOD — OR Load

[OR] [SHF] [LOD]

●Relay Circuit



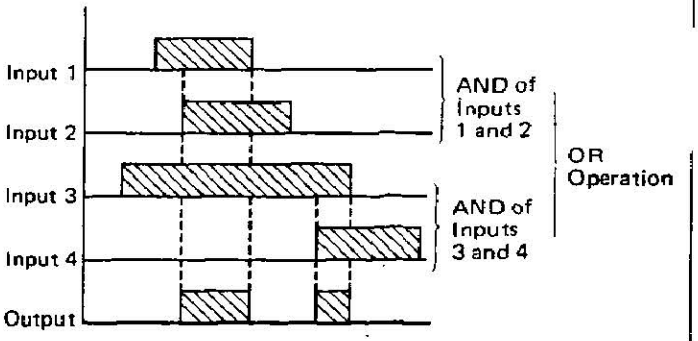
●Program List

Address	Instruction Word	Data
0	LOD	1
1	AND	2
2	LOD	3
3	AND	4
4	OR·LOD	

●Key Operation

Address				
0	LOD	1	ENTR	
1	AND	2	ENTR	
2	LOD	3	ENTR	
3	AND	4	ENTR	
4	OR	SHF	LOD	ENTR

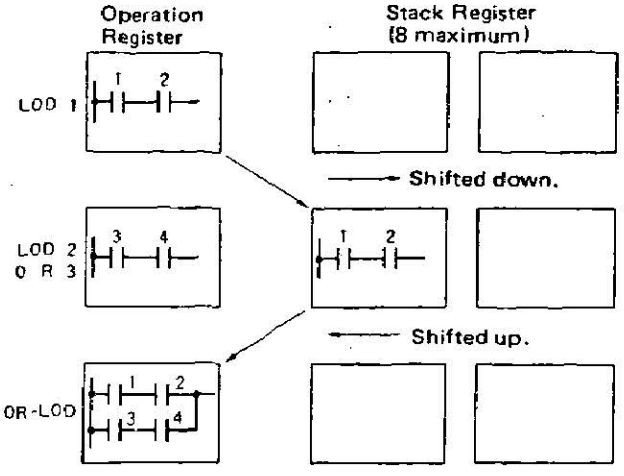
●Time Chart



●Circuits starting with LOD are connected in parallel.

Supplementary

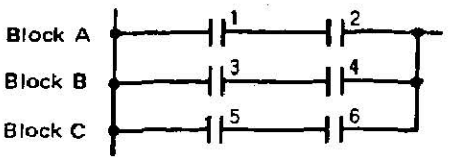
●Operation register and stack register statuses



The OR LOD instruction is used to connect circuits starting with a LOD instruction in parallel.

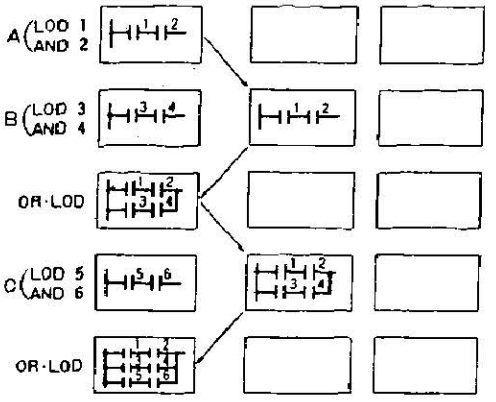
Example

For the following circuit example, the OR LOD instruction can be used in two ways.



●Program 1

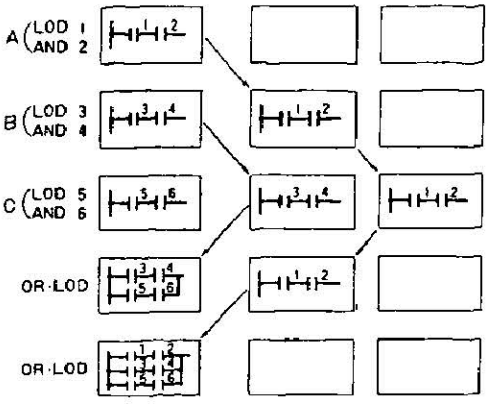
Instruction Word	Data
LOD	1
AND	2
LOD	3
AND	4
OR·LOD	
LOD	5
AND	6
OR·LOD	



Programs (Blocks A and B) stored respectively by LOD1 and LOD3 are read by the OR LOD instruction, thus forming a circuit connected in parallel.
Then, Block C starting with LOD5 is programmed, and the Block A/B circuits are connected in parallel with the Block C circuit by the OR LOD instruction.

●Program 2

Instruction Word	Data
LOD	1
AND	2
LOD	3
AND	4
LOD	5
AND	6
OR·LOD	
OR·LOD	



After Blocks A, B, and C are stored in sequence, the OR LOD instructions are used continuously two times, and the circuits of Blocks A, B, and C are connected in parallel sequentially.
In this case, note the sequence of the stored circuits and the number of read operations. The relation between the LOD instructions used and the number of OR LOD instructions is as follows.

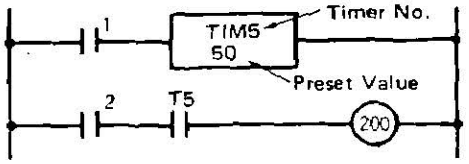
The number of OR LOD instructions
= The number of LOD instructions − 1

TIM **Timer**

- Timer numbers 0 to 79 are 100msec countdown timers.

100msec Timer

- **Relay Circuit**



- **Program List**

Address	Instruction Word	Data
0	LOD	1
1	TIM	5
2		50
3	LOD	2
4	AND·TIM	5
5	OUT	200

- **Key Operation**

Address

0 ··· LOD 1 ENTR

1 ··· TIM 5 ENTR

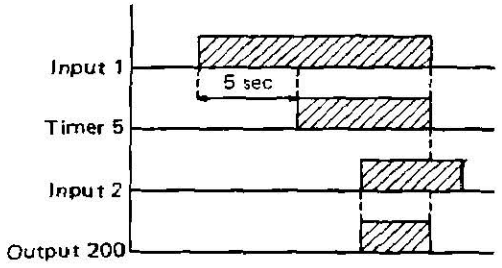
2 ··· 5 0 ENTR

3 ··· LOD 2 ENTR

4 ··· AND SHF TIM 5 ENTR

5 ··· OUT 2 0 0 ENTR

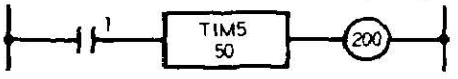
- **Time Chart**



- Timer preset values are 0 to 9999.
- When timer instructions are programmed, two addresses are always required. A timer instruction and timer No. should be set at the first address, and the preset value should be set at the second address (always the next address).

Supplementary

1. - When the operation result immediately before this instruction (which is a timer input) is ON, clock pulse counting is initiated.
   - When the counted value reaches the preset time, the timer output turns ON.
   - When the timer input is OFF, the preset value is set.
   - After the time up, the counted value remains at 0 until the timer input turns OFF.
   - The same timer number cannot be programmed more than once. (Error message "DOUBLE ERROR" is displayed when the program is entered.)
   - If the preset value is changed during a timing operation, the timer remains unchanged with the previous preset time for that cycle, and is changed from the next time cycle. (However, if the preset value is changed to 0, the timer stops operation, immediately turning the output ON.)
2. An output can be programmed immediately after the TIM instruction.

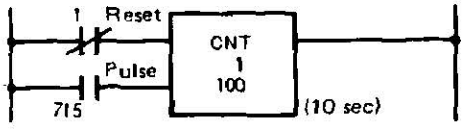


Instruction Word	Data
LOD	1
TIM	5
	50
OUT	200

3. Timer Accuracy

Error	Maximum	+ 3 scan time
	Minimum	−100 msec + 1 scan time
Fluctuations when a 1-sec timer is made (when one scan requires 10 msec)		+3% to −9%

4. Power Failure Memory Type Timer
An ordinary timer does not have power failure memory protection. A power failure memory type timer can be formed using the 100-msec special internal relay (715) or the 1-sec clock (714) and a CNT instruction.



Instruction Word	Data
LOD·N	1
LOD	715
CNT	1
	100

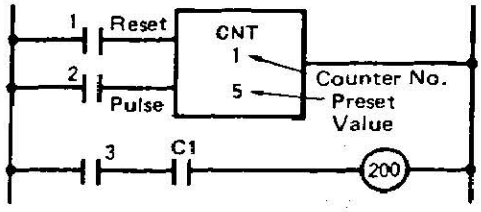
Note: In this case, the counter must be designated to be held at the starting time using FUN7.

CNT **Counter**

- Two types of counters can be selected, depending on their numbers.
  1. Counter Nos. 0 to 44 are adding counters.
  2. Counter Nos. 45 and 46 are reversible counters.

1. Adding Counter

- **Relay Circuit**



- **Program List**

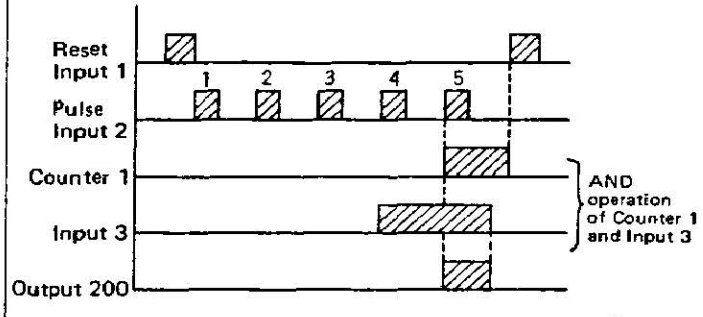
Address	Instruction Word	Data
0	LOD	1
1	LOD	2
2	CNT	1
3		5
4	LOD	3
5	AND·CNT	1
6	OUT	200

- **Key Operation**

Address / Keyboard

0 ··· LOD 1 ENTR
1 ··· LOD 2 ENTR
2 ··· CNT 1 ENTR
3 ··· 5 ENTR
4 ··· LOD 3 ENTR
5 ··· AND SHF CNT 1 ENTR
6 ··· OUT 2 0 0 ENTR

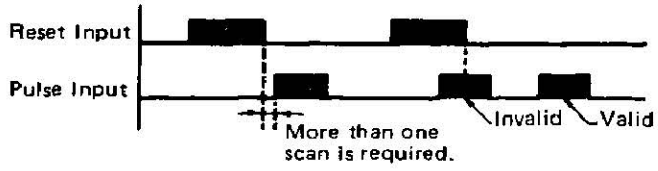
- **Time Chart**



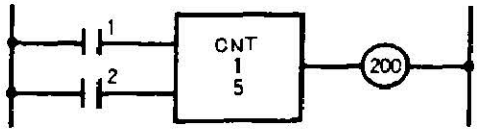
- 45 adding counters are available: Nos. 0 to 44.
- The counter should be programmed in the order of reset input, pulse input and CNT instruction.
- The counter preset values are 0 to 9999.

Supplementary

1. - The same counter number cannot be programmed more than once.
   - While the reset input is OFF, the counter counts the leading edges of pulse inputs, and compares them with the preset value. When the counted value reaches the preset value, the counter turns output ON and the output remains ON until the reset input is turned ON.
   - When the reset input is changed from OFF to ON, the counted value is reset; while the reset input is ON, all pulse inputs are rejected.
   - When power is OFF, the counter's counted value can be held using the FUN (function) designation. (Refer to FUN7 on page 48.)
   - Since the reset input has priority, the counter counts only the pulse input which has changed from OFF to ON subsequent to one scanning after the reset input changed from ON to OFF.



2. The output can be programmed immediately after the CNT instruction.



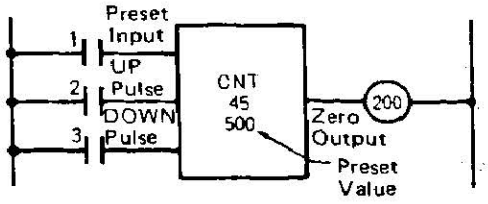
Instruction Word	Data
LOD	1
LOD	2
CNT	1
	5
OUT	200

2. Reversible Counter (Output ON at Counted Value 0)

The reversible counters are available in two types: (A) Counter No. 45 is a dual-pulse type having UP and DOWN pulse inputs. (B) Counter No. 46 is an UP/DOWN selection type which has a pulse input and an up/down selection input to switch the up/down gate.

(A) Dual-pulse Type Reversible Counter

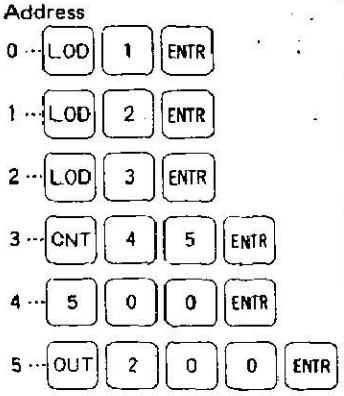
●Relay Circuit



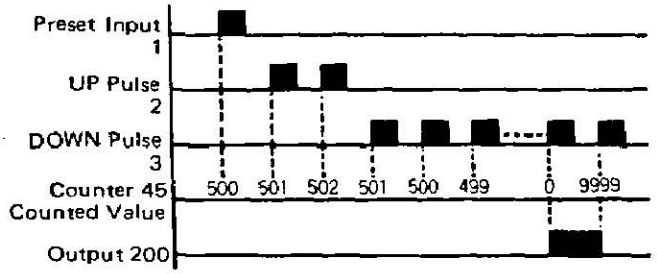
●Program List

Address	Instruction Word	Data
0	LOD	1
1	LOD	2
2	LOD	3
3	CNT	45
4		500
5	OUT	200

●Key Operation



●Time Chart

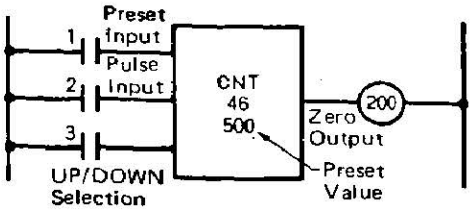


Supplementary

- When both UP and DOWN pulses are ON simultaneously, the counter does not perform counting.
- Three inputs are required: preset input, UP pulse and DOWN pulse.
- When the preset input goes ON, the preset value is set, and when the preset input goes OFF, counting is started.
- The counter output is ON only when the counted value is 0.
- After the counted value reaches 0 or 9999, it changes from 0 to 9999 or from 9999 to 0.
- When a reversible counter is programmed and operated for the first time, the counter will not operate properly if the preset input has not turned ON. The preset input must be turned ON to set the preset value into the counter. The preset value is not cleared by the reset input designated by FUN5.

(B) UP/DOWN Selection Type Reversible Counter

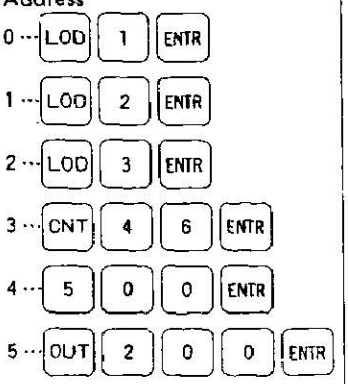
●Relay Circuit



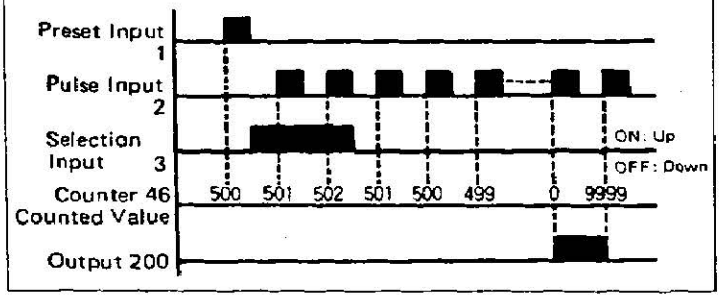
●Program List

Address	Instruction Word	Data
0	LOD	1
1	LOD	2
2	LOD	3
3	CNT	46
4		500
5	OUT	200

●Key Operation



●Time Chart



Supplementary

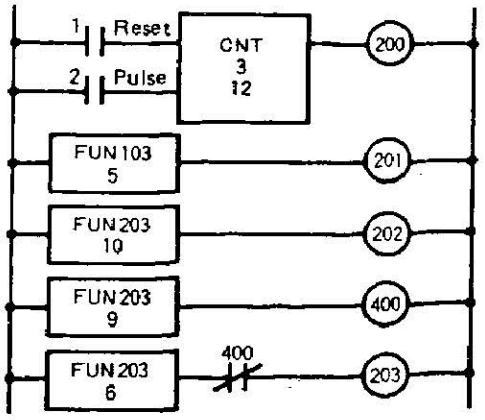
- The UP/DOWN selection input selects the counting mode depending on the input condition.

  ON: UP count
  OFF: DOWN count

- The same counter number cannot be programmed more than once.
- When the preset value is changed during counter operation, the new preset value becomes effective immediately.

FUN100 to FUN146 Counter Equivalent Comparison Instruction, FUN200 to FUN246 Counter Equal To or Greater Than Comparison Instruction

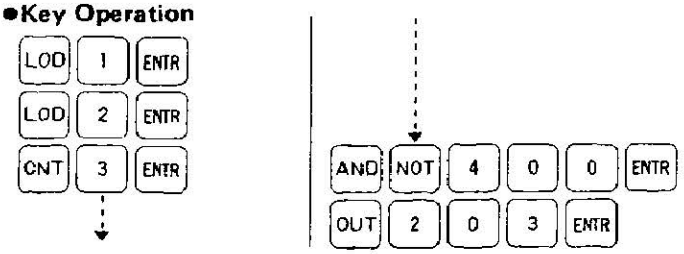
●Counter Multi-stage Setting Example



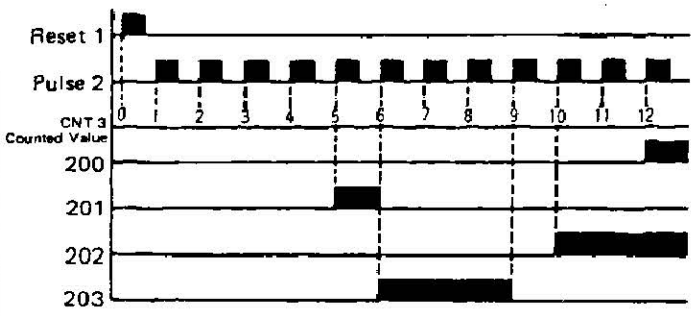
●Program List

Address	Instruction Word	Data	Address	Instruction Word	Data
0	LOD	1	9		10
1	LOD	2	10	OUT	202
2	CNT	3	11	FUN	203
3		12	12		9
4	OUT	200	13	OUT	400
5	FUN	103	14	FUN	203
6		5	15		6
7	OUT	201	16	AND·N	400
8	FUN	203	17	OUT	203

●Key Operation



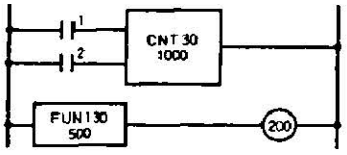
●Time Chart



- 47 counters (0 to 46) can perform equivalent comparison and equal to or greater than comparison operations with respect to optional values.
- Corresponding to counter Nos. 0 to 46, FUN100 to FUN146 (Counter No. + 100) are equivalent comparison instructions and FUN200 to FUN246 (Counter No. + 200) are equal to or greater than comparison instructions.

Supplementary

1. ●Regardless of the status of the counter, this instruction merely compares the counted value.
   - ●Both comparison instructions have the same functions as the LOD instruction but do not have a function corresponding to the AND and OR instructions; therefore, insert an internal relay if required.
   - ●The same FUN number can be used repeatedly for different preset values.
2. Sample Program for Equivalent Comparison

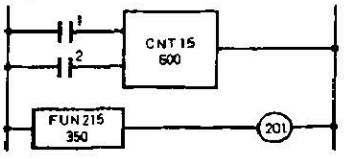


Instruction Word	Data
LOD	1
LOD	2
CNT	30
	1000
FUN	130
	500
OUT	200

●Time Chart

Output 200 is turned ON when the counted value is 500.

3. Sample Program 1 for Equal To or Greater Than Comparison

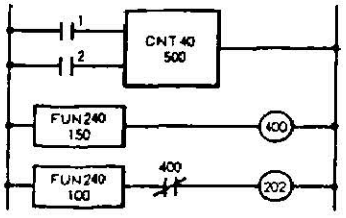


Instruction Word	Data
LOD	1
LOD	2
CNT	15
	600
FUN	215
	350
OUT	201

●Time Chart

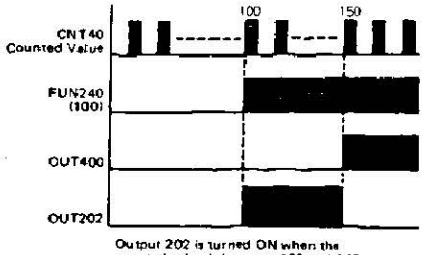
Output 201 is turned ON when the counted value is between 350 and 600.

4. Sample Program 2 for Equal To or Greater Than Comparison



Instruction Word	Data
LOD	1
LOD	2
CNT	40
	500
FUN	240
	150
OUT	400
FUN	240
	100
AND·N	400
OUT	202

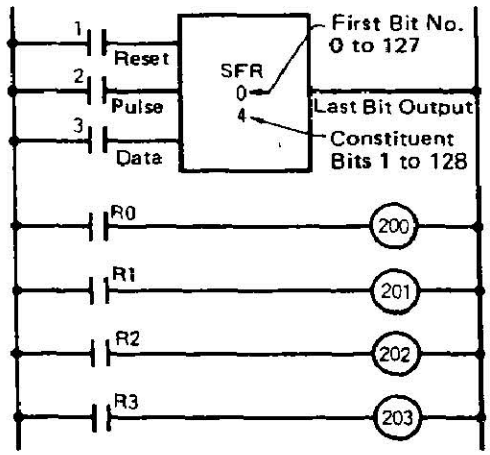
●Time Chart



Output 202 is turned ON when the counted value is between 100 and 149.

SFR Shift Register in Forward Direction

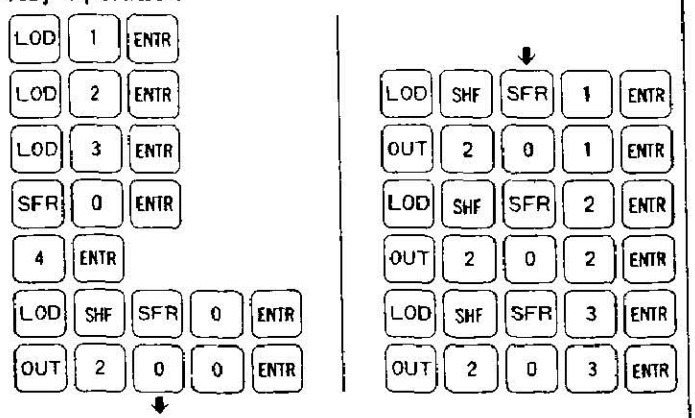
●Relay Circuit



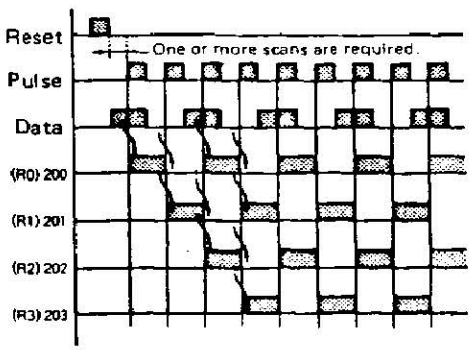
●Program List

Address	Instruction Word	Data	
0	LOD	1	
1	LOD	2	
2	LOD	3	
3	SFR	0	←First bit
4		4	←4-bit configuration
5	LOD·R	0	←Load Bit 0 status
6	OUT	200	
7	LOD·R	1	←Load Bit 1 status
8	OUT	201	
9	LOD·R	2	←Load Bit 2 status
10	OUT	202	
11	LOD·R	3	←Load Bit 3 status
12	OUT	203	

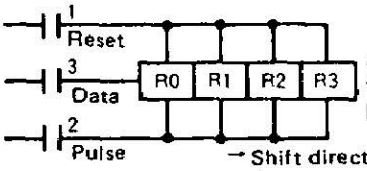
●Key Operation



●Time Chart

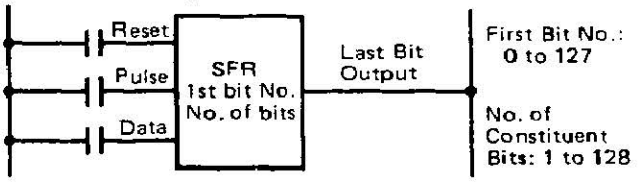


●Structural Concept



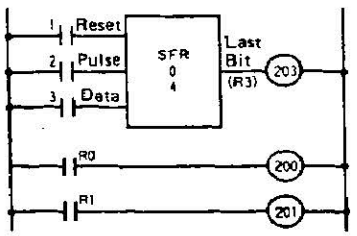
- The shift register has a total of 128 bits, and an optional number of bits can be specified for the shift register.
- The shift register must be programmed in the order of reset input, pulse input, data input, and shift register instruction.
- The shift register requires two addresses for programming. The first bit number is set at the first address and the number of constituent bits at the second address.

Forward Shift Register



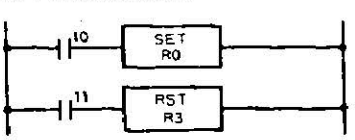
Supplementary

- Each bit status can be loaded using LOD, SHF and SFR instructions.
- The last bit status can also be outputted after the SFF instruction.



Instruction Word	Data	
LOD	1	
LOD	2	
LOD	3	
SFR	0	
	4	
OUT	203	←The last bit status is outputted.
LOD·R	0	}
OUT	200	} Each bit status is loaded.
LOD·R	1	}
OUT	201	}

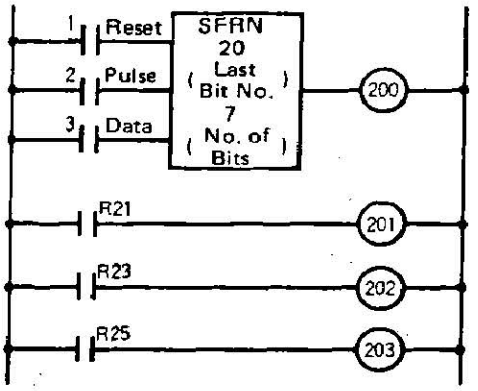
- An optional bit can be turned ON (SET) or OFF (RST) using the SET or RST instruction.



The SET or RST instruction can be actuated by an optional input condition. The bit number to be turned ON or OFF must be specified after the SET or RST instruction.

SFR NOT Shift Register in Reverse Direction

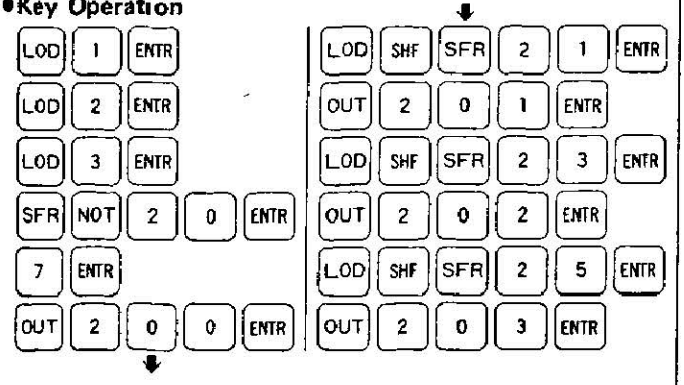
•Relay Circuit



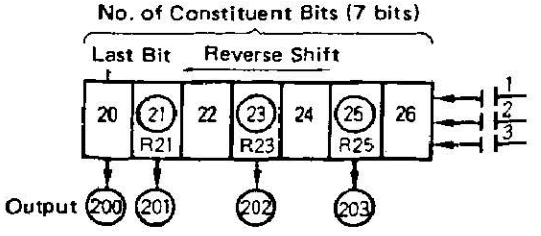
•Program List

Address	Instruction Word	Data	
0	LOD	1	
1	LOD	2	
2	LOD	3	
3	SFR·N	20	← Last bit
4		7	← 7-bit configuration
5	OUT	200	
6	LOD·R	21	← Load Bit 21 status
7	OUT	201	
8	LOD·R	23	← Load Bit 23 status
9	OUT	202	
10	LOD·R	25	← Load Bit 25 status
11	OUT	203	

•Key Operation

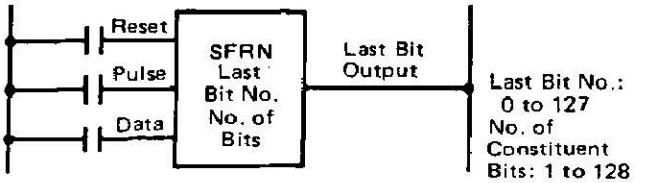


•Structural Concept



Only the bits marked with ○ are outputted.

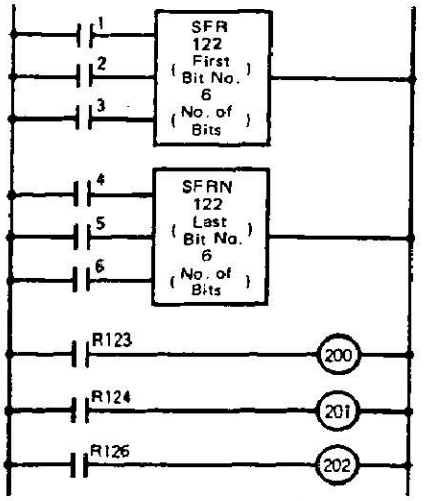
•For the reverse shifting, use the SFR NOT instruction and program the last bit No. at the first address.



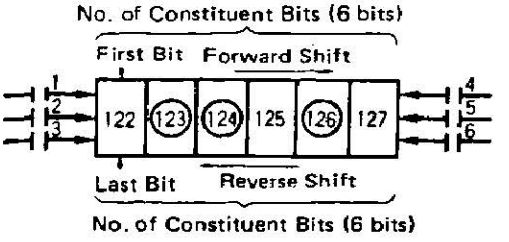
Supplementary

•A bidirectional shift register can be made by combining a forward shift register and a reverse shift register.

•Example of a bidirectional shift register



Instruction Word	Data
LOD	1
LOD	2
LOD	3
SFR	122
	6
LOD	4
LOD	5
LOD	6
SFR·N	122
	6
LOD·R	123
OUT	200
LOD·R	124
OUT	201
LOD·R	126
OUT	202

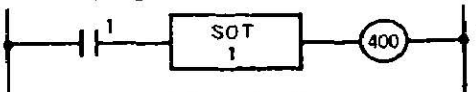


Only the bits marked with ○ are outputted.

SOT Single Output

●Relay Circuit

(Leading edge differentiation of NO input)



(Trailing edge differentiation of NC input)

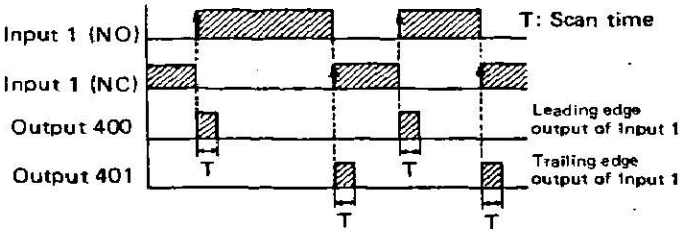
●Program List

Address	Instruction Word	Data
0	LOD	1
1	SOT	1
2	OUT	400
3	LOD-NOT	1
4	SOT	2
5	OUT	401

●Key Operation

LOD 1 ENTR
SOT 1 ENTR
OUT 4 0 0 ENTR
LOD NOT 1 ENTR
SOT 2 ENTR
OUT 4 0 1 ENTR

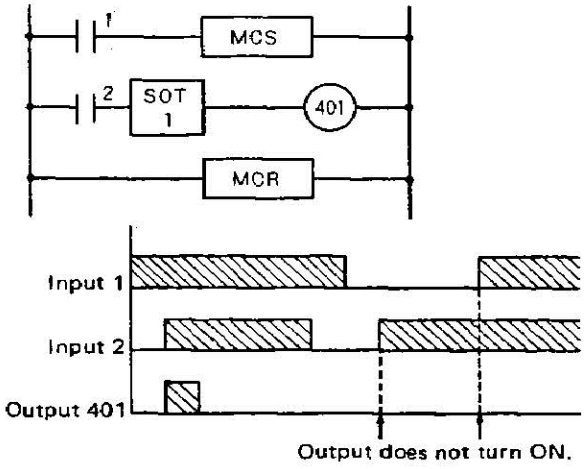
●Time Chart



- ●The SOT instruction converts (differentiates) an input to a single pulse signal.
- ●When the input signal goes ON, the SOT output goes ON for a period of one scan.
- ●When a relay output is specified, the output may not operate depending on the scan time.
- ●A maximum of 96 SOT instructions (0 to 95) can be used.
- ●The same SOT number cannot be used repeatedly.

Note

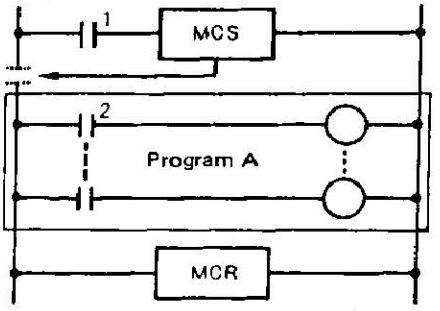
1. If operation is started with SOT input signal ON, the SOT output does not turn ON. To turn ON the SOT output, the input signal must turn ON after starting operation.
2. If an SOT instruction is used between MCS and MCR instructions and the SOT input 2 turns ON before or at the same time as the MCS input 1, the SOT output 401 does not turn ON.



MCS Master Control Set , MCR Master Control Reset

MCS and MCR instructions are set using the double key MCS/MCR. Each time the key is pressed, the key alternates MCS and MCR instructions. Confirm the display when programming.

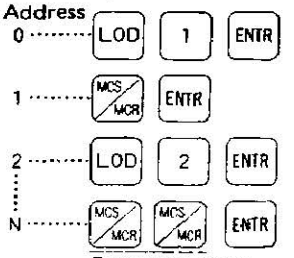
•Relay Circuit



•Program List

Address	Instruction Word	Data
0	LOD	1
1	MCS	
2	LOD	2
3		⋮
⋮		⋮
N	MCR	
⋮		⋮

•Key Operation



Press two times to select MCR.

•When the input to the MCS instruction is OFF, all inputs to the program (Program A) read after the MCS instruction are forced OFF until the MCR instruction is executed: when the input to the MCS instruction is turned OFF, the program (Program A) up to the MCR is inhibited from operating.

•The MCS instruction must be used in combination with the MCR instruction.

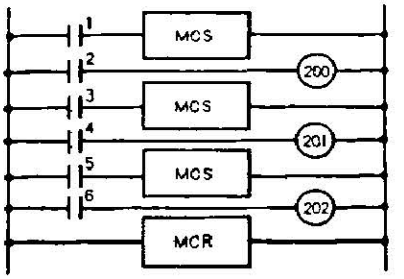
Supplementary

1. Input conditions cannot be set for the MCR instruction. When the MCS ends with an MCR or END, all values of the logical operation and stack registers are turned OFF. The END instruction has the same function as the MCR instruction.
2. Instruction statuses during execution of MCS instruction

Instruction	Status
SOT, OUT	All instructions are turned OFF.
SET, RST	All instructions are kept.
TIM	Counted values and outputs are reset.
CNT, SFR	Counted values are kept. Pulse inputs are turned OFF. Outputs are turned OFF.

Note: The execution of MCS instruction means that the input condition is in the OFF state.

3. More than one MCS instruction can be set for one MCR instruction.

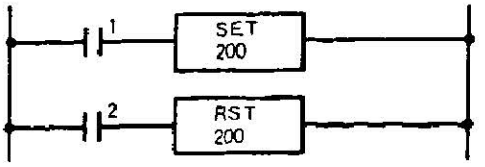


The above master control circuit gives priority to Input 1, Input 3, and Input 5 in this order.

4. MCS/MCR instructions cannot be nested in another pair of MCS/MCR instructions.

SET Set , RST Reset

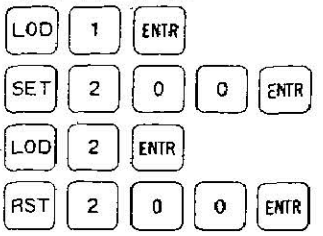
•Relay Circuit



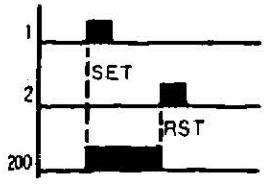
•Program List

Address	Instruction Word	Data
0	LOD	1
1	SET	200
2	LOD	2
3	RST	200

•Key Operation



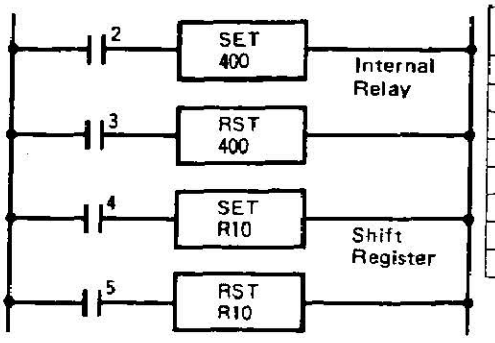
•Time Chart



•Outputs, internal relays and shift registers can be set (ON) or reset (OFF) using the SET or RST instruction.

Supplementary

1. Sample Program



Instruction Word	Data
LOD	2
SET	400
LOD	3
RST	400
LOD	4
SET	R10
LOD	5
RST	R10

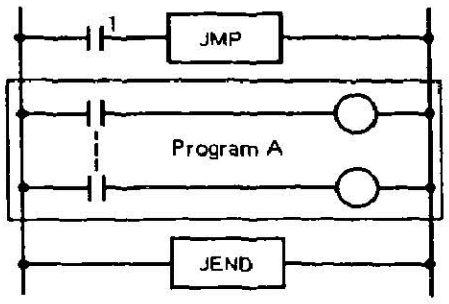
2. SET and RST instructions can be used for the same output repeatedly.

Note: SET and RST instructions operate in each scan while the input signal is ON.

JMP Jump , JEND Jump End

JMP and JEND instructions are set using the double key JMP/JEND. Each time the key is pressed, the key alternates JMP and JEND instructions. Confirm the display when programming.

● Relay Circuit



● Program List

Address	Instruction Word	Data
0	LOD	1
1	JMP	
⋮	Program A	
N	JEND	

● Key Operation

Address
0 ····· LOD 1 ENTR
1 ····· JMP/JEND ENTR
N ····· JMP/JEND JMP/JEND ENTR

Press two times to select JEND.

● When the input to the JMP instruction is ON, the JMP becomes valid, thus executing the program up to the JEND instruction without processing (holding all statuses); when the input is OFF, the JMP becomes invalid and the subsequent program is executed.

Supplementary

1. JMP/JEND instructions cannot be nested in another pair of JMP/JEND instructions.
2. During execution of a JMP instruction, all statuses between the JMP and JEND are held.
   - Outputs, internal relays, timers, counters, and shift registers are held in their current statuses.
   - Timer and counter counted values are also held.
   - SOT instructions are all turned OFF.
3. The difference between MCS and JMP is that the program within the JMP/JEND instructions is not executed; for example, if an output has been ON before JMP execution, the output remains ON during the JMP execution.

END End

● Relay Circuit

● Program List

Address	Instruction Word	Data
0		
1		
2		
⋮		
N	END	

● An END instruction is always required at the end of a program.

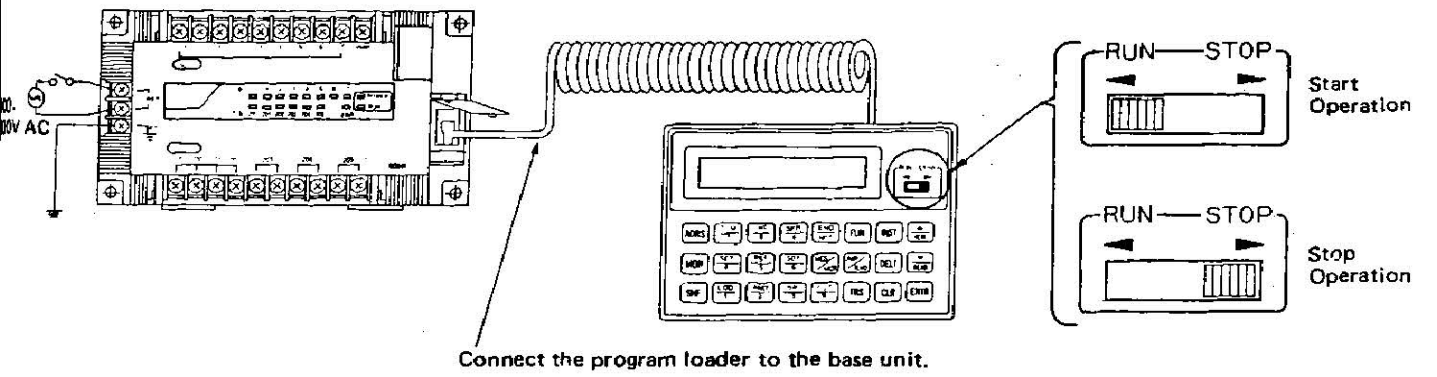
Supplementary

1. When the entire user memory is cleared, END instructions are written at all addresses.
2. ● Execution of instructions from address 0 of the program memory to the address where the END instruction is written is referred to as a scan. The time required for this execution is referred to as the scan time. Therefore, the scan time depends on the address of the END instruction.
   ● The END instruction transfers the results processed within one scan for every END instruction to the output, and then reads in the status of the input in preparation for the next scanning operation.

START/STOP OPERATION

1. Start & Stop Using Program Loader

MICRO-1 operation can be started and stopped using the switch on the program loader.

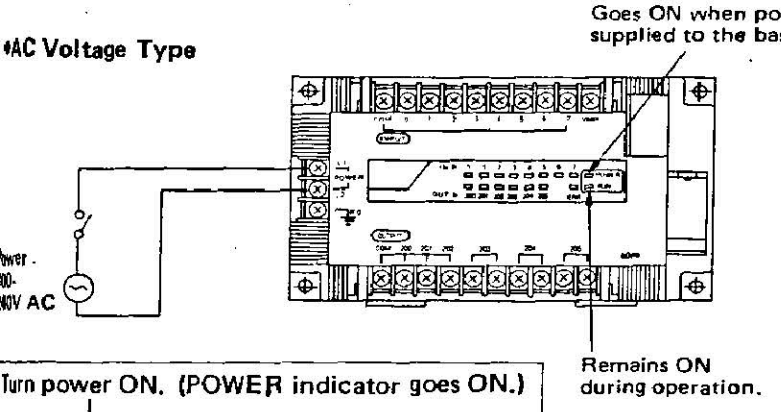


Connect the program loader to the base unit.

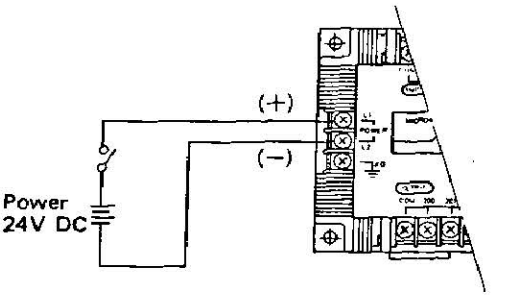
2. Start & Stop by Power Supply

When power is turned ON, operation starts, and when power is turned OFF, operation stops.
(After the RUN/STOP switch on the program loader has been set to STOP, operation cannot be started by turning power ON. Set the switch to RUN before starting operation using power supply.)

●AC Voltage Type



●DC Voltage Type

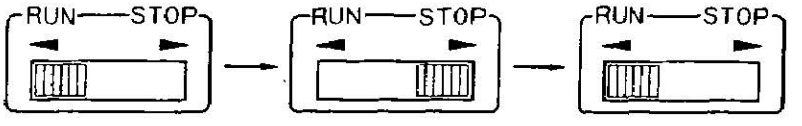


Turn power ON. (POWER indicator goes ON.)
↓
(Approx. 5 sec later)
↓
RUN state (RUN indicator goes ON.)

Supplementary

1. The MICRO-1 memorizes the RUN/STOP status immediately before power is turned OFF. Therefore, when power is restored in the power failure protection period of 3 days, the MICRO-1 maintains the same RUN or STOP status as before power was turned OFF. When power is restored after 3 days, the MICRO-1 takes the RUN status regardless of the status before power outage, but the program is maintained.
2. If the RUN/STOP status stored in the MICRO-1 differs from the RUN/STOP switch position on the program loader when power is restored, set the RUN/STOP switch to match the status stored in the MICRO-1 and return the switch, then the MICRO-1 status is changed as the switch position.

[Ex.] If the RUN/STOP switch on the program loader is at RUN but operation does not start when power is turned ON, then set the RUN/STOP switch to STOP and return the switch to RUN.



If the RUN/STOP switch is at STOP but operation starts when power is turned ON, then set the switch to RUN and return the switch to STOP.

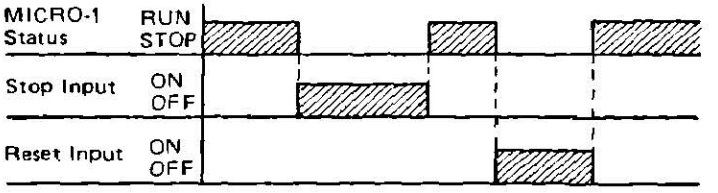
Note RUN/STOP Operation Response Time

1. RUN to STOP: The MICRO-1 stops operation immediately.
   After 2 seconds, "PC-STOP" is displayed on the program loader.
   After another 7 seconds, the program is displayed.
2. STOP to RUN: The MICRO-1 starts operation after 1.5 seconds.
   After another 1.5 seconds, "PC-RUN" is displayed on the program loader.
   After another 7 seconds, the program is displayed.

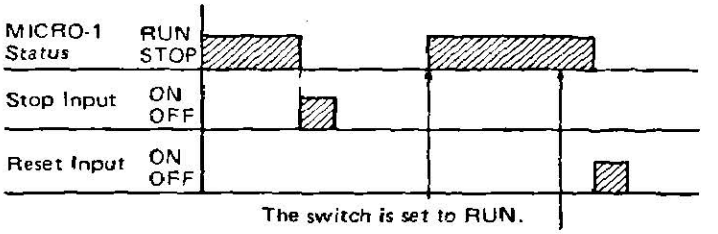
3. Stop & Reset by External Signal

- For systems requiring stop and reset inputs, any input number can be designated using FUN. For the setting method, see FUN4 and FUN5 on page 46.
- When a stop or reset input is turned ON during program operation, the RUN LED goes OFF and operation stops. (All outputs are turned OFF.)
- The reset input has precedence over the stop input.

(When the RUN/STOP switch on the program loader is at RUN)



(When the RUN/STOP switch on the program loader is at STOP)



Note:
When a stop input has been designated by FUN4 and the stop input is OFF (during RUN), operation cannot be stopped using the program loader.

4. Start & Stop by Special Internal Relay

Special internal relays 701 and 702 take the status shown below while the MICRO-1 is in RUN or STOP status.

Special IR / Status	701	702
RUN	OFF	OFF
STOP	ON	OFF

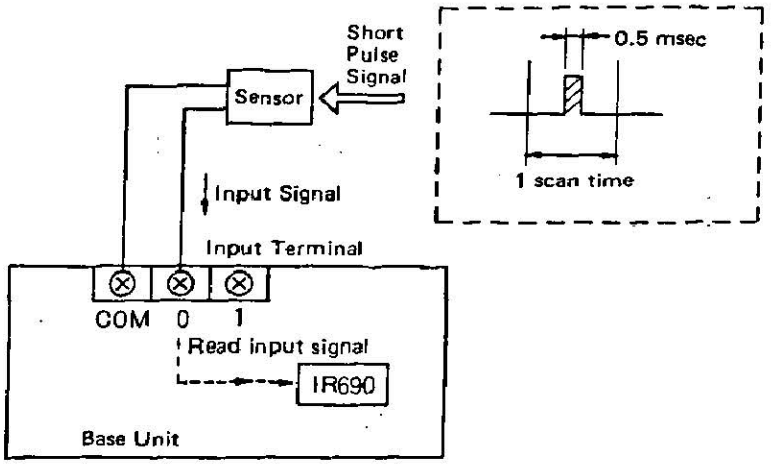
Operation can be started or stopped by turning special internal relay 701 OFF or ON using the RST or SET key on the program loader.

- Internal relay 701 can be reset (OFF) to start operation by pressing: TRS RST 7 0 1 ENTR
- Internal relay 701 can be set (ON) to stop operation by pressing: TRS SET 7 0 1 ENTR

Supplementary **Data statuses in start, stop and reset modes.**

Mode	Output	IR/SFR Status CNT Counted Value		T/M Current Value	CNT45 & 46 Counted Value
		Power-failure Keep Area	Power-failure Non-keep Area		
RUN	Operating	Operating	Operating	Operating	Operating
Reset	OFF	Cleared	Cleared	Maintained	Maintained
Stop	OFF	Maintained	Maintained	Maintained	Maintained
At start	Maintained	Maintained	Cleared	Cleared	Maintained

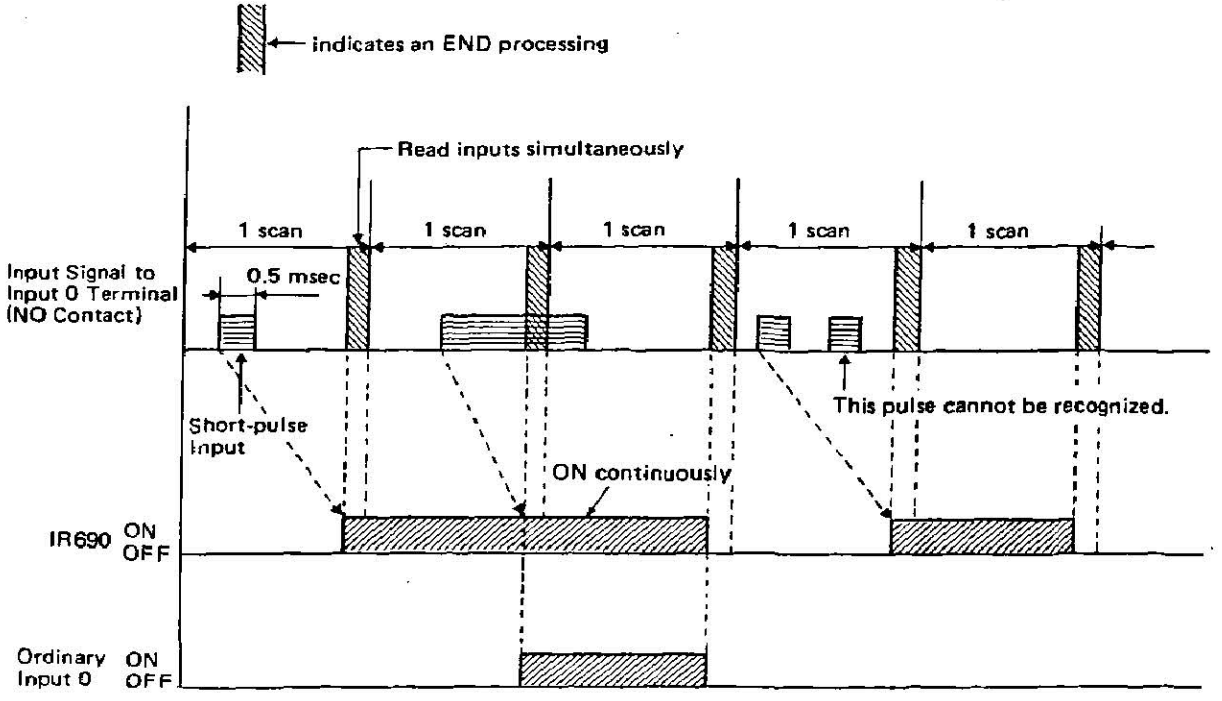
CATCH INPUT (Short-pulse Input: 0.5 msec) READ FUNCTION



Input 0 terminal has a catch input (short-pulse input) read function in addition to the ordinary input function. Since ordinary input signals are read simultaneously when the END instruction is executed at the end of a scan, input signals shorter than one scan time may not be read. Input 0 has a function to read short-pulse signals of 0.5 msec without fail. (When short-pulse inputs are counted by a counter, one catch input can be counted in every two scans.) The read short-pulse input is set to special internal relay 690 (IR690) which can be programmed in a relay circuit. Operations of ordinary input and short-pulse input are illustrated below.

Catch Input Operation Chart

1) Normally Open Input

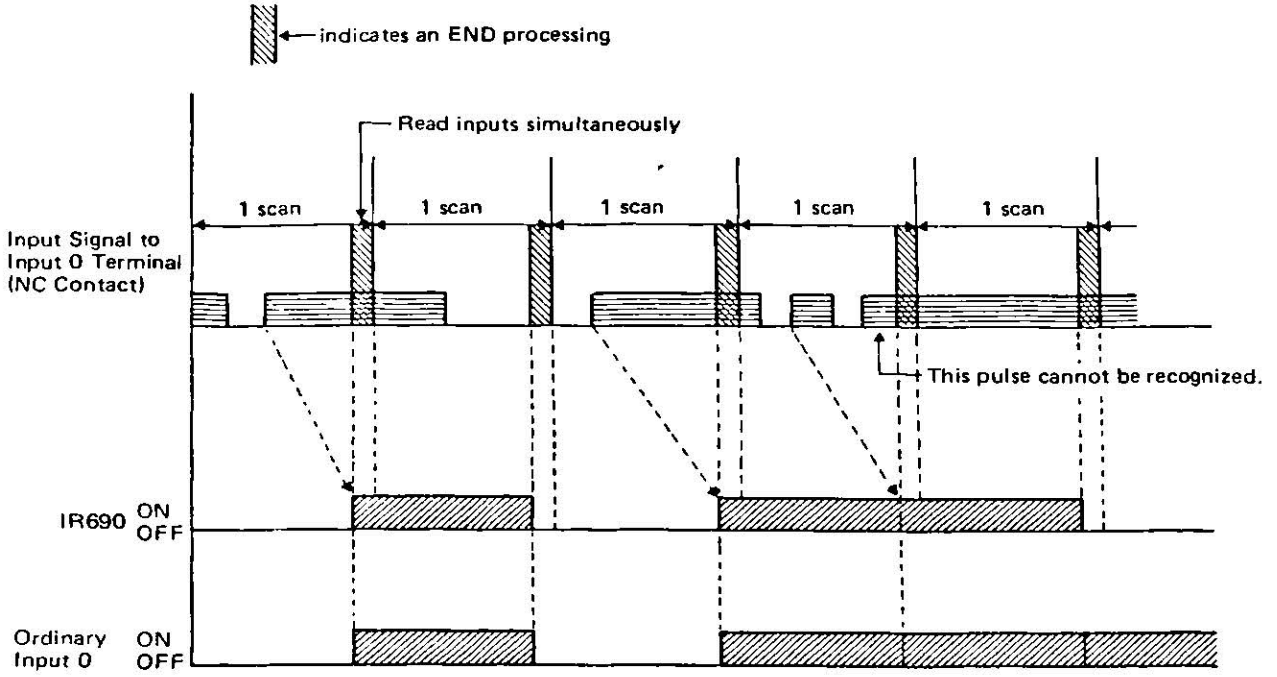


Note 1: If the catch input turns ON in every scan, IR690 remains ON.

Note 2: IR690 goes ON for a period of one scan after the catch input has turned ON.

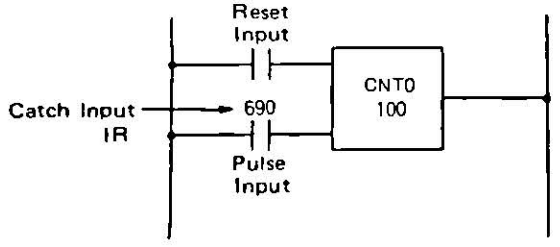
Note 3: If Input 0 is ON at the time of simultaneous reading, the input is read to the ordinary input (No. 0). Pulse inputs shorter than one scan time are read to IR690.

(2) Normally Closed Input



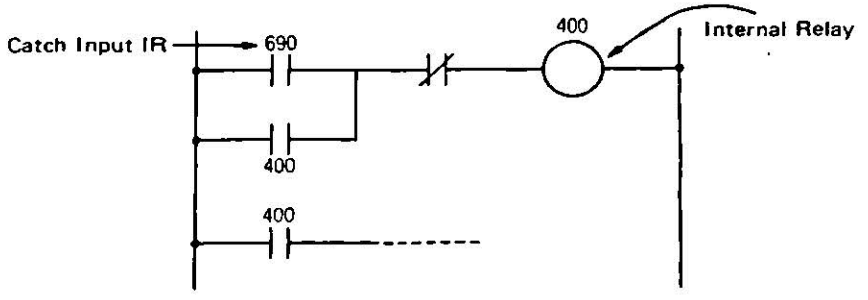
2. Sample Programs

(1) Example to count catch inputs using a counter



Note: When the catch input (IR690) is used for the pulse input of the counter, one pulse input can be counted in two scans. Pulse inputs occurring in every scan cannot be counted.

(2) Example of self-maintained circuit to hold the catch input for more than one scan



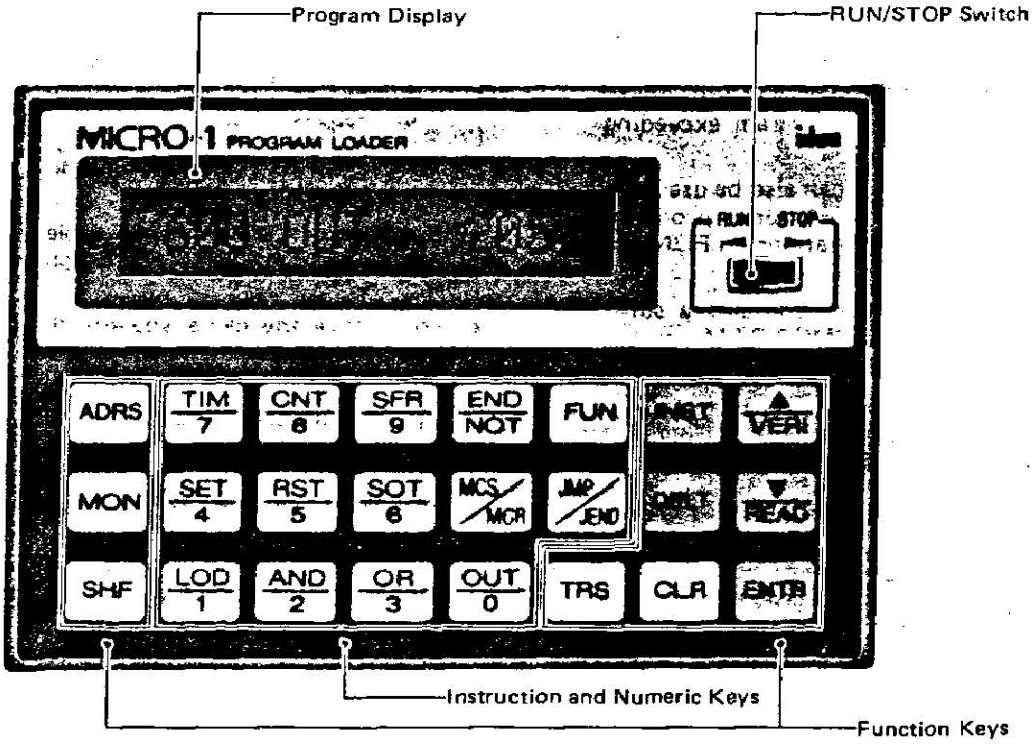
Note: When the input terminal No. 0 is not used for the catch input, Input No. 0 can be programmed as an ordinary input.

PROGRAMMING

User programs for the MICRO-1 programmable controller are programmed using the FC1A-HL1E program loader.
In addition, programs can also be made using the PFA-1H401RE, PFA-1H404RE or PF2-2H4RE program loader and the optional loader extension cable FC1A-KL3.
Application software Ladder Input Program is available for programming on an IBM compatible personal computer.
This chapter describes the programming method using the FC1A-HL1E program loader.

1. Program Loader (FC1A-HL1E)

1) Part Description and Function



Program Display . . . . . Displays programs and other data on the LCD.
RUN/STOP Switch . . . . . Allows to start or stop the MICRO-1 operation.
Instruction and Numeric Keys . . . . . See page 19 for their functions.
Function Keys . . . . . See the table below.

•Function Keys

Key	Function
ADRS	Reads out the address to the display.
MON	Monitors the I/O, IR, timer, counter or shift register status on the display.
SHF	Changes the function of double keys TIM, CNT and SFR. [Ex.] To enter LOD TIM, press the LOD, SHF and TIM keys, then ⬚ blinks on the right of the display.
TRS	Transfers or verifies programs between the program loader and the base unit.
INST	Inserts program instructions.
DELT	Deletes program instructions.
CLR	Initializes the display or aborts the processing.
▲	Changes the display of address, monitor, FUN or searching program instructions in the ascending order.
▼	Changes the display of address, monitor, FUN or searching program instructions in the descending order.
VERI	Verifies programs between the base unit and the program loader
READ	Reads out FUN on the display or programs in the base unit to the program loader.
ENTR	Transfers a program from the program loader to the base unit or acknowledges key operation.

(2) Program Capacity

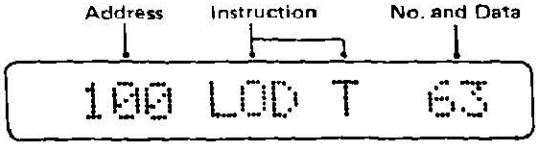
Program Loader Type No.	Program Capacity
FC1A-HL1E	964 steps maximum

Supplementary

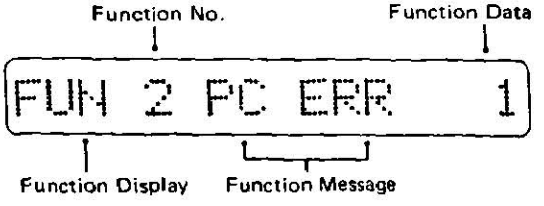
1. The FC1A-HL1E program loader has a program capacity of 964 steps, but the MICRO-1 base unit has a program capacity of 600 steps. Therefore, if operation of a program including more than 600 steps is attempted, an error will result.
2. In programming, inputs and outputs can be allocated up to the allocation numbers of the FA series programmable controller (128 inputs and 128 outputs), but the MICRO-1 can use Inputs 0 to 7 and 10 to 17 and Outputs 200 to 205 and 210 to 217 (16 inputs and 14 outputs). Transferring a program exceeding this range will result in a program error.
3. The FC1A-HL1E program loader can also be used as a 1K-step program loader for the FA series programmable controllers, with some limitations on FUN and other operations.
4. The FC1A-HL1E program loader contains a super capacitor to back up the built-in CMOS-RAM memory for a period of approximately 3 minutes.

(3) Display Examples

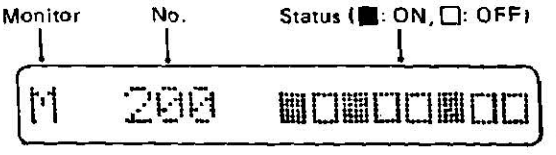
●Program Display



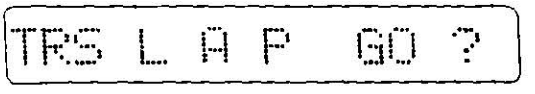
●FUN (Function) Display



●Monitor Display

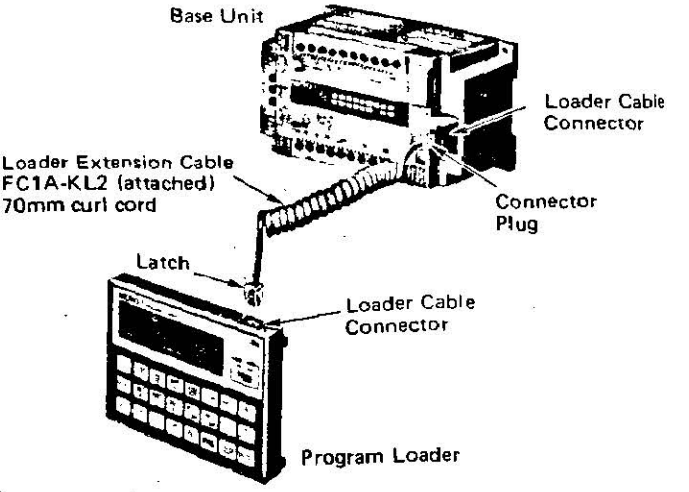


●Message Display



(4) Connection and Mounting on Base Unit

ble Connection to Base Unit)



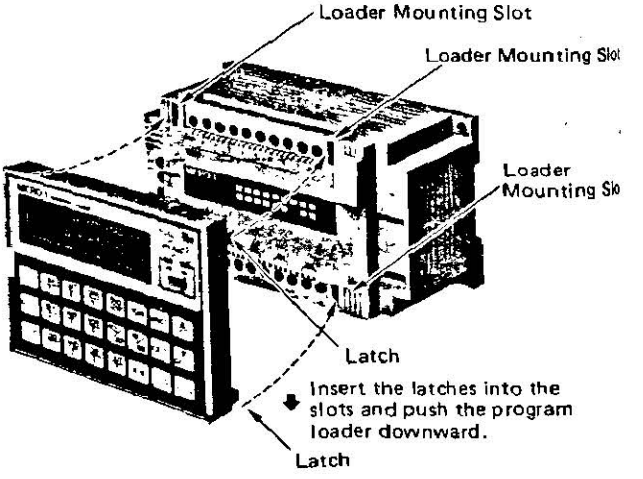
1. Plug in the loader extension cable into the connectors in the base unit and the program loader until the latch is locked.
2. To remove the cable, squeeze the latch and pull the connector plug out.

Supplementary

1. The connector plugs on both ends of the loader extension cable can be inserted to either connector in the base unit or the program loader.
2. In addition to the FC1A-KL2 (70mm curl cord) attached to the program loader, the FC1A-KL1 loader extension cable (1.5m long) is also available optionally.

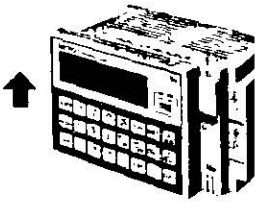
●Mounting on Base Unit

The base unit has four slots to mount the program loader. Insert the latches on the back of the program loader into the slots and push the loader downward. The program loader is held in place.



●Removing from Base Unit

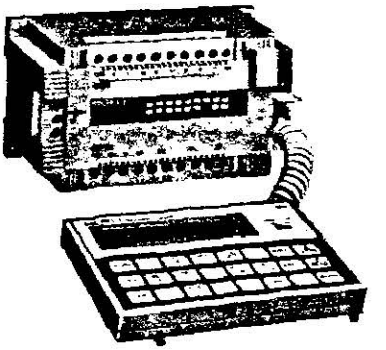
Push the program loader upward to release the latches.
The program loader can be removed.



Programming Procedures

Supply power.

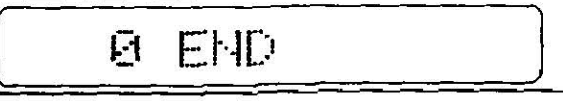
1. Connect the program loader to the base unit using the loader extension cable. The program loader is powered by the base unit.
2. When power is supplied, a beep is heard and "POWER ON" is displayed.
3. After approximately 5 seconds, the base unit status is displayed.
   "PC — RUN" when the base unit is in operation.
   "PC — STOP" when the base unit is in halt.
   Whether the base unit is in operation or halt, programming can be done with the program loader.



Clear the user memory in the program loader.

●Key Operation [DELT] [END] [ENTR]

●Display



Programming.

FUN initial settings . . . . . See page 47.
Basic operating procedures . . . . . See page 41.

Ⓐ

Check the program.

●Key Operation [FUN] [9] [8] [READ]

Program is correct.

NO

●Display

Syntax error address is displayed. └ Address

YES

●Display (Note)

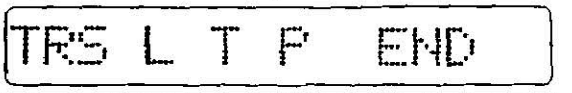
Go to Check the program Ⓐ ← Correct the program.

Transfer the program to the base unit.

●Key Operation [TRS] [ENTR] [ENTR]

Note: Program cannot be transferred while the base unit is in operation.

●Display when program transfer is complete.



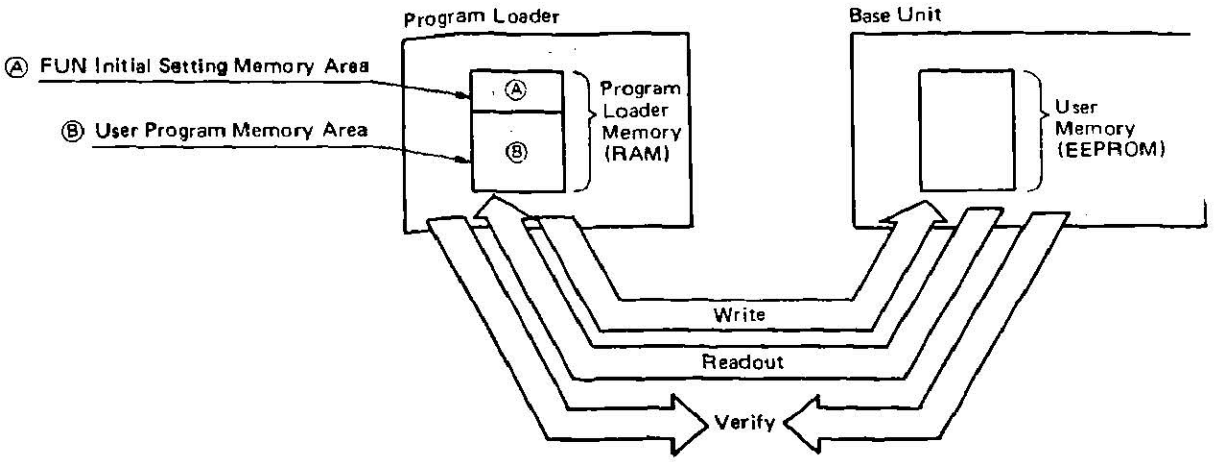
Start operation.

※ ERROR LED is ON, see page 77.

FUN98 program check does not check inputs and outputs, therefore after checking a program including I/O numbers over the MICRO-1 I/O allocation, "CHECK OK" is displayed. When such a program is transferred, an error will result and the program cannot be run.

Supplementary

Relation between FUN initial setting and user program



The FUN initial settings and user program are stored in the program loader RAM memory. They are written into the user memory in the base unit by writing operation simultaneously.

Supplementary

Programming for the FA series programmable controller using the MICRO-1 program loader.

1. The following can be programmed:
   - Program of 0 to 963 steps (1K steps)
   - FA series instruction words (except 2. listed below)
   - Inputs and outputs within the range of the FA series
   - Addressed jump instruction (FUN300)
2. The following cannot be programmed:
   - Computing instructions (FUN147 and FUN247)
   - CNT FUN instruction (for FA-1)
   - FUN36 to FUN39 and FUN96 settings
   - Program capacity (FUN1 is fixed at 1K steps)

Note: A special cable is required for connecting the MICRO-1 program loader to the FA series programmable controller
Loader Extension Cable: Type No. FC1A-KL4

3. Basic Operating Procedures

•Basic Operations List

Operation	Purpose	Key Operating Procedures	Page
Clear User Memory	The entire user program memory in the program loader is cleared.	DELT END ENTR	42
Select Program Address	An address is selected for the program in the program loader and the contents at the address are read out.	ADRS Address No. READ (VERI)	42
Enter Program Instruction	A program instruction is entered into the program loader.	Select Address ↓ Instruction Key No. ENTR	43
Read Out Program Instruction	Program instructions in the program loader are read out in the descending or ascending order.	▼ READ or ▲ VERI	43
Delete Program Instruction	A specified number of program instructions are deleted starting at the selected address.	Select Address ↓ DELT No. of Instructions ENTR	44
Insert Program Instruction	A program instruction is inserted at the selected address.	Select Address ↓ Instruction Key No. INST	44
Change Timer/ Counter Preset Value during Operation	A timer or counter preset value is changed during operation.	TRS □ × × READ (No. — TIM or CNT) × × × × ENTR (New Preset Value)	45
Operation by SET/ RST Instruction	An I/O, internal relay, special internal relay or shift register is set (ON) or reset (OFF) using the program loader only during operation.	TRS SET (SHF SFR) × × × ENTR (No. — Required only for shift register) ↑ or RST	46

Clear User Memory

The entire program memory in the program loader is cleared and END instructions are written at all addresses. Be sure to clear the program memory before starting programming.

Operation

DELT END ENTR

●Key Operation and Display

DELT END ENTR

Supplementary

1. Initial settings and FUN settings are also cleared by this operation.
2. The program in the base unit user memory is not cleared.

Select Program Address

An address is selected for the program in the program loader. When the selected address is larger than the maximum step number (963 steps), a beep is heard to indicate an error, then retry to select a correct address.

Operation

ADRS Address No. READ (VERI)

●Key Operation and Display

ADRS 1 2 3 READ

Supplementary

1. An address can be selected either in operation or halt.
2. Pressing the CLR key three times indicates Address 0.

●Key Operation

CLR CLR CLR

●Display

(Address)

Note: The maximum address for the MICRO-1 is step 599. The program loader allows a maximum of 964 steps to be programmed for a 1K-step program used for the FA series programmable controller.

Enter Program Instruction

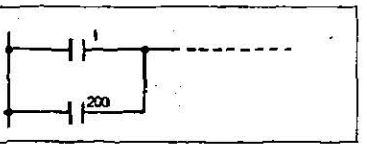
A program instruction is entered into the memory in the program loader.

Operation

Select Address → Instruction Key → No. → ENTR

Key Operation and Display

Key operation procedure for this circuit is shown below.



LOD 1 → 0 LOD 1

ENTR → 1 END

OR 2 0 0 → 1 OR 200

ENTR → 2 END

Supplementary

1. An output number is normally programmed only once; however, some program may require two or more output instructions of the same number. Each time the same output number is pressed on the program loader more than once, a beep is heard but the output instruction is entered.
2. The same timer or counter number cannot be used. When the same timer or counter number is entered repeatedly, DOUBLE ERROR is displayed on the program loader.

DOUBLE ERROR

3. When programming TIM, CNT or SFR instructions requiring two addresses, the first instruction must be programmed first, otherwise the program instruction cannot be entered.

Note 1: When the ENTR key is pressed, the instruction word and data are checked. If an error is found, a beep is heard and the program is not entered.

Note 2: When a program instruction is entered, the address on the display advances to the next address and the program at the address is displayed.

Note 3: A maximum of 964 steps of program instructions can be entered into this program loader, however the MICRO-1 can run a program of up to 600 steps.

Read Out Program Instructions

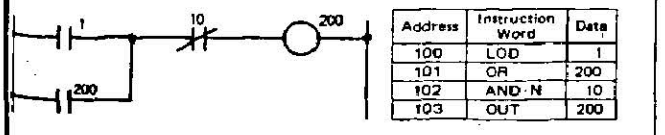
Program instructions in the program loader are read out in the descending or ascending order.

Operation

READ ····· Read out in the descending order

VERI ····· Read out in the ascending order

Key Operation and Display



Address	Instruction Word	Data
100	LOD	1
101	OR	200
102	AND-N	10
103	OUT	200

Key operation procedure for the above program is shown at right

(Select the first address to read out.)

ADRS 1 0 0 READ

(Address)

100 LOD 1

READ → 101 OR 200

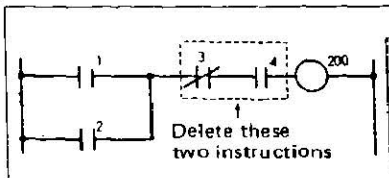
Delete Program Instructions

A specified number of program instructions are deleted starting at the selected address. When deletion is complete, the subsequent program instructions are shifted up.

Operation

Select Address → DELT → No. of Instructions → ENTR

●Key Operation and Display



Address	Instruction Word	Data
90	LOD	1
91	OR	2
92	AND N	3
93	AND	4
94	OUT	200

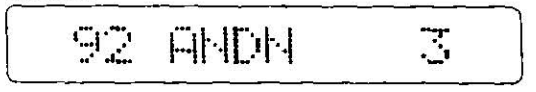
Delete

Key operation procedure for the above program is shown below.

(Select Address 92 to start deleting.)

ADRS 9 2 READ

(Address)



(Enter 2 to delete two instructions.)

DELT 2 ENTR

Supplementary

When an instruction (TIM, CNT, SFR, FUN100 to 146, FUN200 to 246) requiring two addresses is included in the program to be deleted, both addresses are deleted as one program instruction. Therefore, when the first or second address of such a two-address instruction i displayed, a delete operation deletes the instructio from the two addresses at the same time.

First Address →
(Delete 1 address) →

Address	Instruction Word	Data
50	LOD	1
51	TIM	5
52		50
53	LOD	2
54	AND	3

Deleted simultaneously

Address	Instruction Word	Data
50	LOD	1
51	LOD	2
52	AND	3

When deleting one address at Address 51, two addresses 51 and 52 are deleted simultaneously. Similarly when deleting two addresses at Address 51, two address are deleted.

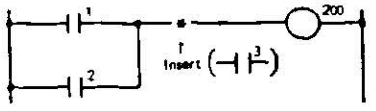
Insert Program Instruction

A program instruction is inserted at a specified address. Select the address to insert a program instruction and enter the program instruction by pressing the INST key instead of the ENTR key. When insertion is complete, the subsequent program instructions are shifted down by one address.

Operation

Select Address → Instruction Key → No. → INST

●Key Operation and Display



Address	Instruction Word	Data
10	LOD	1
11	OR	2
12	OUT	200

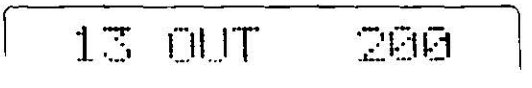
This example is to insert the ⊣⊢ at the position ▪.
For this purpose, insert an "AND3" between addresses 11 and 12.

Select address 12.

ADRS 1 2 READ

(Address)

AND 3 INST



Supplementary

1. When the second address of a two-address instruction (TIM, CNT, etc.) is displayed, a program instruction cannot be inserted.
2. When inserting a two-address instruction, the instru tion word for the first address must be inser before inserting the second address.

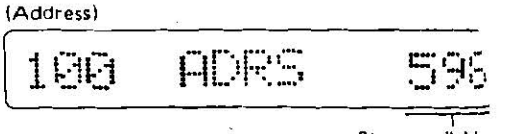
Display Remaining Steps

The number of remaining steps in the program lo available for programming can be displayed.

Operation

Key Operation: ADRS ▼

(Address)



Steps available for programmin

Note: The MICRO-1 can run a program of steps di played minus 364 steps.

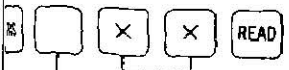
hange Timer/Counter Preset Value during Operation

er or counter preset values can be changed during operation.

eration

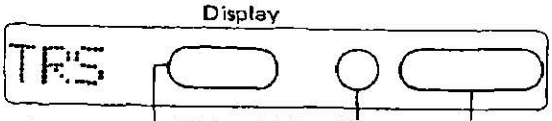
Read out the timer or counter number to change its preset value.

Operation



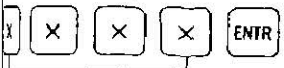
No.
TIM or CNT

Display



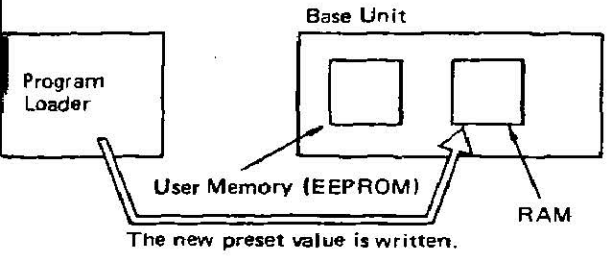
TIM or CNT No. Preset Value

Enter a new preset value.



New Preset Value

In procedures (1) and (2) above, the new preset value is written into the RAM memory in the base unit; the program in the user memory (EEPROM) is not changed.



The new preset value is written.

ew timer/counter preset value in the base unit is maintained for approximately 3 days during a failure at 25°C.

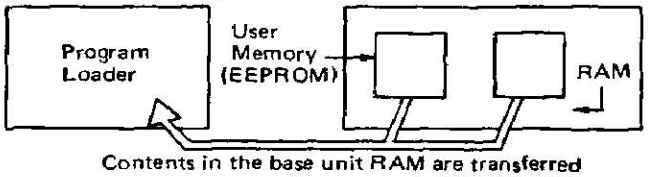
e the new timer/counter preset value into the memory (EEPROM)

Stop operation.

Transfer the new preset value from the base unit RAM to the program loader.

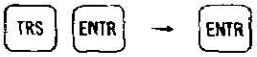
Operation

● Movement of program and data



Contents in the base unit RAM are transferred to the program loader.

(3) Transfer the new preset value from the program loader to the base unit user memory (EEPROM) where the program is stored.

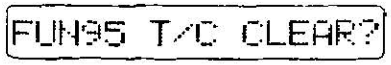


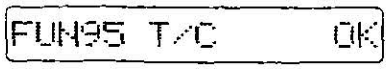
Note: If this operation is not performed, the new preset value will be lost after 3 days.

Supplementary 1

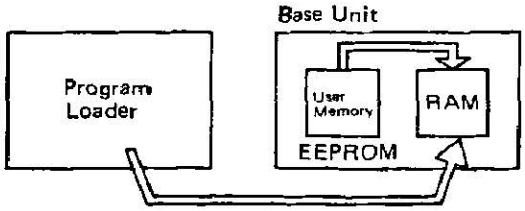
Operating procedure to restore the old preset value.

Key Operation





● Movement of program and data



The data (timer/counter old preset value) in the base unit user memory (EEPROM) is written into the base unit RAM.
This operation restores all timer/counter old preset values. When you want to restore specific timer/counter old preset values, enter the original values individually.

Supplementary 2

● **User Memory**
This memory stores the user program.

● **RAM Memory**
This memory temporarily stores the current values of internal relays, timers, counters, and shift registers.

Operation by SET/RST Instruction

An I/O, internal relay, special internal relay or shift register can be set (ON) or reset (OFF) using the program loader only during operation.

Operation

TRS SET (SHF SFR) × × × ENTR

SET: or RST
SFR: Required only for shift register.
×: No.

- **Key Operation and Display**
  (To set Output 200.)

TRS SET 2 0 0 ENTR

Note

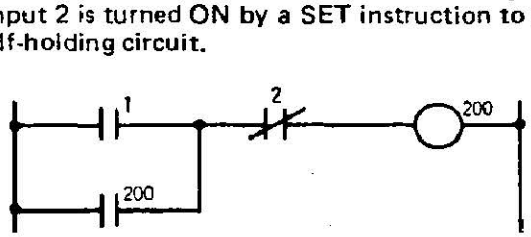
The following can be controlled.

(1) Both SET/RST instruction turn ON or OFF only when the ENTR key is pressed. In the next execution, operation is performed as per the program.
- Output: Nos. 200 to 205, Nos. 210 to 217
- Internal Relay: Nos. 400 to 597
- Special Internal Relay: Nos. 703 to 713
- Shift Register: Nos. 0 to 127

(2) The input is set (ON) or reset (OFF) during one scan time.
- Input: Nos. 0 to 17

[Example]

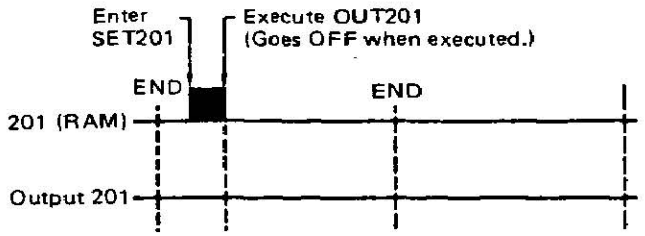
In the following example circuit, Input 1 is turned ON by a SET instruction to actuate the self-holding circuit, and Input 2 is turned ON by a SET instruction to release the self-holding circuit.



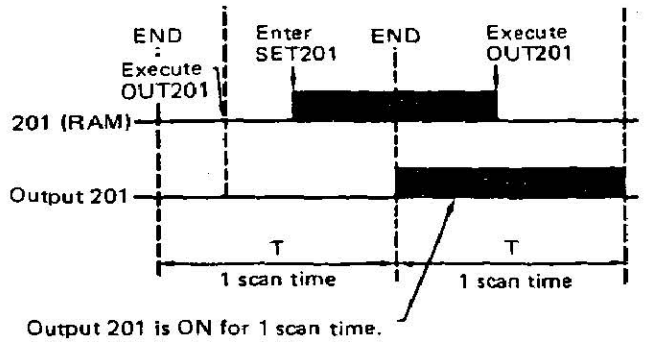
Supplementary

The time charts when the output in the following sample circuit is turned ON by the SET instruction:
These time charts show the difference in operation of the SET instruction performed (1) before and (2) after the execution of output.

(1) When SET201 is entered before OUT201 is executed.



(2) When SET201 is entered after OUT201 is executed



Note 1: If 201 (RAM memory) is ON when an END instruction is executed, Output 201 also goes ON. If 201 (RAM memory) is OFF, Output 201 also goes OFF.

Note 2: As described above, it should be noted that the output cannot be turned ON or OFF, depending on the timing when the SET/RST instruction is entered.

4. FUN Initial Settings

The MICRO-1 allows for function settings using the FUN key on the program loader. The settings are written into the base unit user memory by transferring the user program from the program loader.

•FUN Initial Settings List

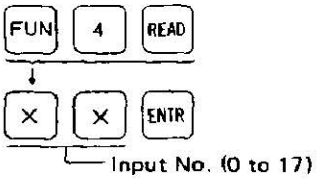
Name	Function	Setting Range	Default	Clearing Method	FUN No.	Page
Stop Input No. Setting	Any input terminal can be designated as a stop input terminal.	Inputs: 0 to 17	0	Enter an output number. [Ex.] 200	FUN4	48
Reset Input No. Setting	Any input terminal can be designated as a reset input terminal.	Inputs: 0 to 17	0	Enter an output number. [Ex.] 200	FUN5	48
Internal Relay Keeping Designation	•Internal relay statuses (IR400-597) are cleared during a power failure. •Internal relays can be designated as keep types whose statuses are maintained or clear types whose statuses are cleared when restarting operation. •The default is all clear types.	Internal relays: 400 to 597 All internal relays are designated as keep types by setting 700.	0	•Enter No. 400. •Enter No. 0.	FUN6	49
Counter Keeping Designation	•Counter counted values (adding counter Nos. 0-44) are cleared during a power failure. •Counters can be designated as keep types whose counted values are maintained or clear types whose counted values are cleared when restarting operation. •The default is all clear types.	Counters: 0 to 44 All counters are designated as keep types by setting 45.	0	Enter No. 0.	FUN7	50
Shift Register Keeping Designation	•Shift register bit statuses (Nos. 0-127) are cleared during a power failure. •Shift register bits can be designated as keep types whose statuses are maintained or clear types whose statuses are cleared when restarting operation. •The default is clear types.	Shift register bits: 0 to 127 All shift register bits are designated as keep types by setting 128.	0	Enter No. 0.	FUN8	50
Timer/Counter Counted Value External Display	Timer current values or counter counted values can be displayed on an external digital display unit.	•Counters 0 to 46: 900 to 946 •Timers 0 to 79: 1000 to 1079	0	Enter No. 0.	FUN32	51
Key Matrix Setting	A key matrix can be set for a maximum of 64 points consisting of 8 inputs and 8 outputs.	•Key matrix scan disable: 0 •Inputs 0 to 7 enable: 1 •Inputs 10 to 17 enable: 10	0	Enter No. 0.	FUN34	51
External Display Latch Condition Setting	The latch condition for the digital display unit can be set when using the external display function.	•Low (L) latch: 0 •High (H) latch: 1	0	–	FUN35	52
Communication Device No. Registration	Device numbers can be registered for a 1:N communication personal computer link system.	•Device No.: 1 to 255	0	Enter No. 0.	FUN60	52

Note: When the user program is cleared, all FUN settings are reset to default value 0.

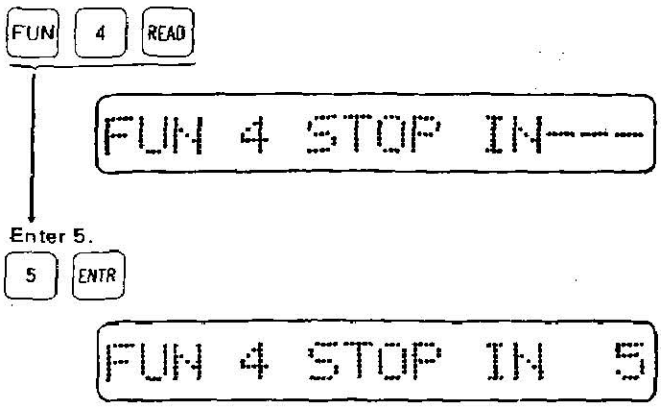
Stop Input No. Setting (Readout and Registration) FUN4

The MICRO-1 is not provided with a special stop input terminal and any input terminal can be designated as a stop input terminal. When the designated input terminal goes ON, the MICRO-1 stops operation.

Operation



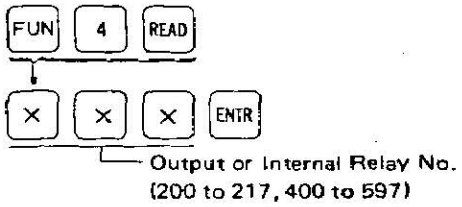
●Key Operation and Display



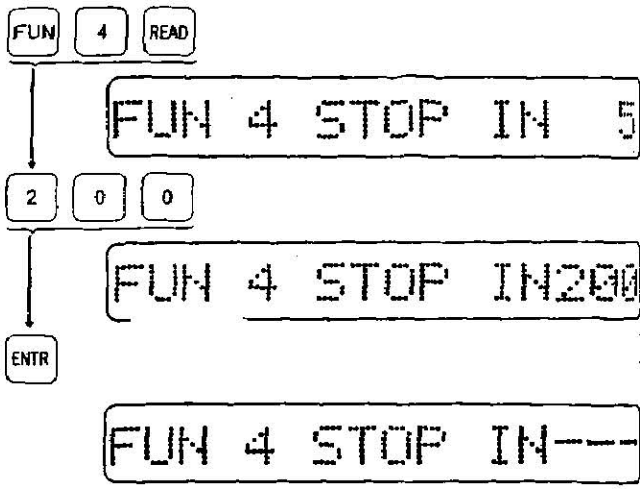
Note 1: This setting must be completed before transferring the user program to the base unit.

Note 2: For the start/stop operation with the RUN/STOP switch on the program loader when a stop input is designated, see page 34.

Clearing Stop Input Setting



●Key Operation and Display

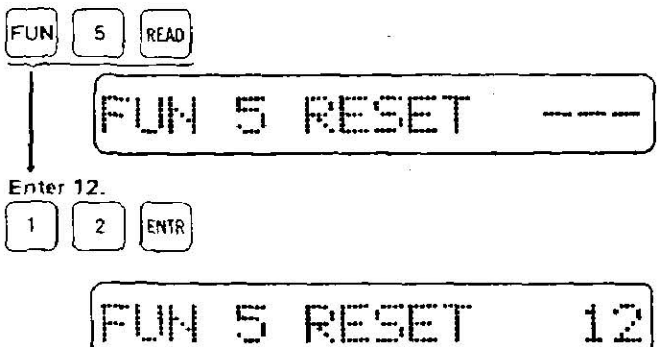


Reset Input No. Setting (Readout and Registration) FUN5

The MICRO-1 is not provided with a special reset input terminal and any input terminal can be designated as a reset input terminal. When the designated input terminal goes ON, all statuses in the MICRO-1 are reset. While the reset input is ON, the MICRO-1 is in halt.

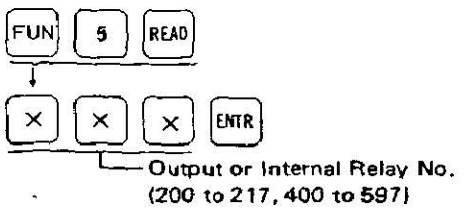
Operation

●Key Operation and Display

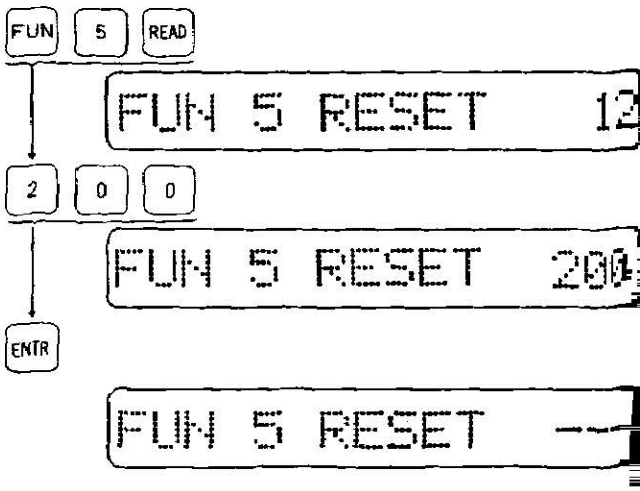


Note: This setting must be completed before transferring the user program to the base unit.

Clearing Reset Input Setting

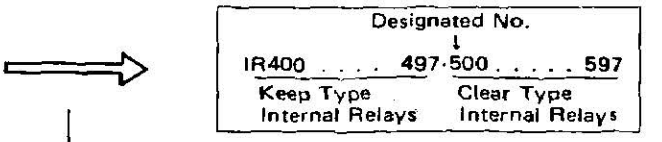


●Key Operation and Display



Internal Relay Keeping Designation — FUN6

1. Internal relay statuses (IR400 to 597) are cleared when a power failure occurs. It is also possible to designate internal relays as keep types whose statuses are maintained when restarting operation.
2. Internal relays from No. 0 to immediately before the designated number are keep types and the other internal relays remain clear types.



Operation

FUN 6 READ

↓

× × × ENTR

Internal Relay No. (400 to 597)

•Key Operation and Display

FUN 6 READ

To designate IR400-497 as keep types (IR500-597 remain clear types), enter 500.

5 0 0 ENTR

Note: This setting must be completed before transferring the user program to the base unit.

Supplementary

1. To designate all internal relays as keep types, enter 700.
2. Special internal relays 600 to 697 are always clear types regardless of the keeping designation.
3. Internal relay Nos. 400 to 597 designation must be done in contiguous blocks.
4. This setting can be modified at any time.

Clearing Internal Relay Keeping Designation

To clear the internal relay keeping designation, enter 400.

FUN 6 READ

↓

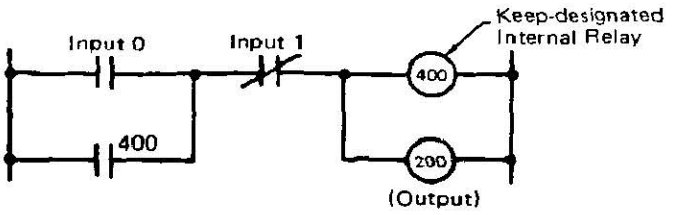
4 0 0 ENTR

Note: After clearing the internal relay keeping designation, transfer the user program to the base unit once again.

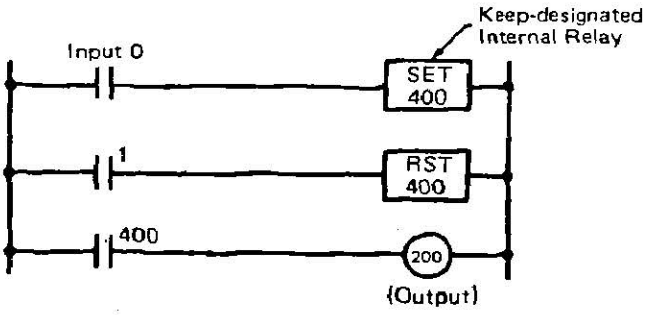
Sample Circuit Configuration

Keep type internal relays perform the same function as clear type internal relays under normal service conditions. However, if a power failure occurs after a keep type internal relay has been set in a self-holding circuit, the internal relay stores the status before power failure and operates when restart is initiated.

[Ex. 1]

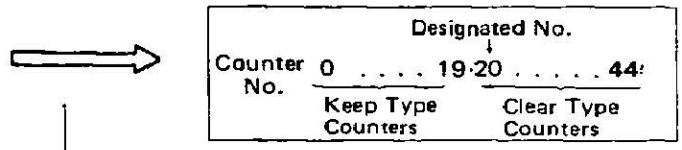


[Ex. 2] When a keep type internal relay is self-maintained by the SET instruction, the status before power failure is also stored in the memory.



Counter Keeping Designation — FUN7

1. Counter counted values (Adding counter No. 0 to 44) are cleared when a power failure occurs. It is also possible to designate counters as keep types whose counted values are maintained when restarting operation.
2. Counters from No. 0 to immediately before the designated number are keep types and the other counters remain clear types.



Operation

FUN 7 READ
↓
× × ENTR
Counter No. (0 to 44)

● Key Operation and Display

FUN 7 READ

FUN 7 CNT 0

To designate Counters 0 to 19 as keep types (Counters 20 to 44 remain clear types), enter 20.

2 0 ENTR

FUN 7 CNT 20

Note: This setting must be completed before transferring the user program to the base unit.

Supplementary

1. To designate all counters (Nos. 0 to 44) as keep types, enter 45.
2. Reversible counters 45 and 46 are keep types. However, their counted values can also be programmed to be cleared when restarting operation.
3. This setting can be modified at any time.

Clearing Counter Keeping Designation

To clear the counter keeping designation, enter 0.

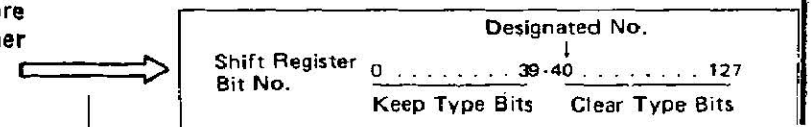
FUN 7 READ 0 ENTR

FUN 7 CNT 0

Note: After clearing the counter keeping designation, transfer the user program to the base unit once again.

Shift Register Keeping Designation — FUN8

1. The status of each bit (0 to 127) of the shift register is cleared when a power failure occurs. It is also possible to designate shift register bits as keep types whose statuses are maintained when restarting operation.
2. Shift register bits from No. 0 to immediately before the designated number are keep types and the other bits remain clear types.



Operation

FUN 8 READ
↓
× × × ENTR
Shift Register Bit No. (0 to 127)

● Key Operation and Display

FUN 8 READ

FUN 8 SFR 0

To designate shift register bits 0 to 39 as keep types (bits 40 to 127 remain clear types), enter 40.

4 0 ENTR

FUN 8 SFR 40

Note: This setting must be completed before transferring the user program to the base unit.

Supplementary

1. To designate all shift register bits (Nos. 0 to 127) as keep types, enter 128.
2. This setting can be modified at any time.

Clearing Shift Register Keeping Designation

To clear the shift register keeping designation, enter 0.

FUN 8 READ 0 ENTR

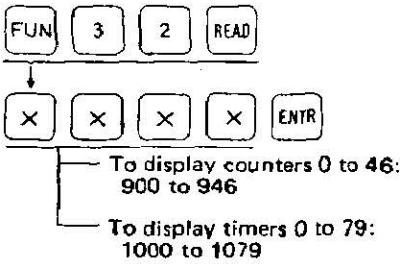
FUN 8 SFR 0

Note: After clearing the shift register keeping designation, transfer the user program to the base unit once again.

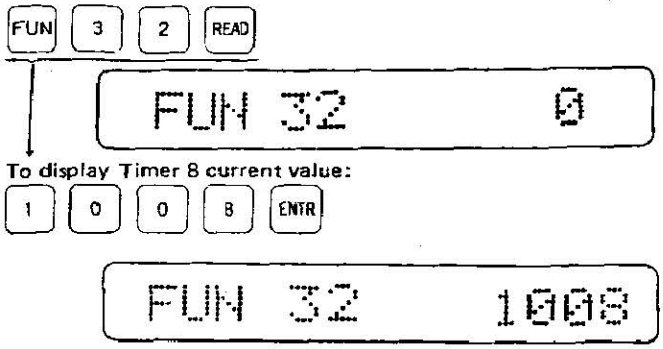
Timer/Counter Counted Value External Display — FUN32

FUN32 setting is required to display timer current values or counter counted values on an external digital display unit.

Operation



•Key Operation and Display



Note: This setting must be completed before transferring the user program to the base unit.

Clearing Timer/Counter Counted Value External Display

To clear the timer/counter counted value external display function, enter 0.

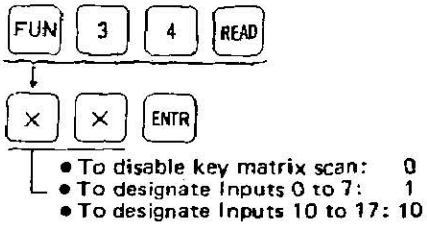
Note: After clearing the counter/timer counted value external display function, transfer the user program to the base unit once again.

For details of timer/counter counted value external display functions, see Serial I/O Module Users Manual EM230.

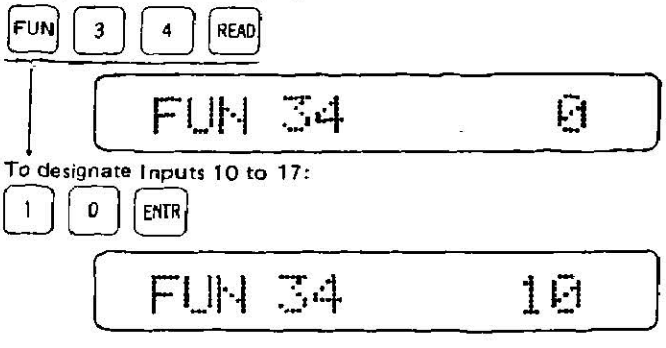
Key Matrix Setting — FUN34

FUN34 setting is used to set a key matrix for a maximum of 64 points consisting of 8 inputs and 8 outputs and to output the ON/OFF statuses to internal relays 600 to 677.

Operation



•Key Operation and Display



Note: This setting must be completed before transferring the user program to the base unit.

Clearing Key Matrix Setting

To clear the key matrix setting, enter 0.

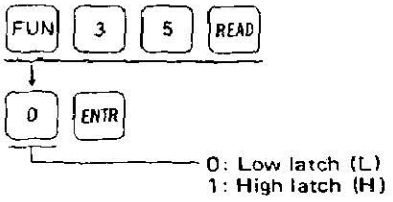
Note: After clearing the key matrix setting, transfer the user program to the base unit once again.

For details of key matrix setting functions, see Serial I/O Module Users Manual EM230.

External Display Latch Condition Setting — FUN35

FUN35 is used to set the latch condition for the digital display unit when using the external display function.

Operation



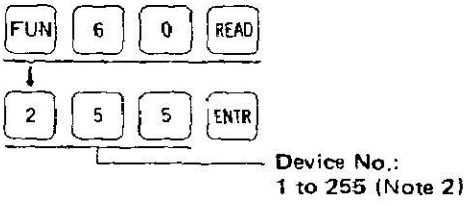
For details of external display functions, see Serial I/O Module Users Manual EM230.

Note: This setting must be completed before transferring the user program to the base unit.

Communication Device No. Registration — FUN60

FUN60 is used to allocate a device number (1 to 255) to each of the MICRO-1 base units connected in a 1:N communication personal computer link system.

Operation



Note 1: This setting must be completed before transferring the user program to the base unit.

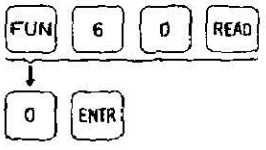
Note 2. Device numbers 1 to 255 can be set but a maximum of 32 MICRO-1 base units can be connected in a 1:N communication personal computer link system.

Supplementary

1. Only the MICRO-1 base unit with the device number called by the personal computer using the device number designation command can be communicated.
2. All MICRO-1 base units in one personal computer link system must be allocated to different device numbers.
3. When the user program is cleared, device number 0 is set.

Clearing Communication Device No. Registration

To clear the communication device number registration, enter 0.



For details of communication device numbers, see FA series 1:N Communication Personal Computer Link System Users Manual EM071.

Other Operations

her FUN operations include checking the program loader and format error checking for a written program.

ther Operations List

Name	Function	Key Operation	Page
splay System ogram Version	The system program version is displayed.	FUN 9 7 READ	54
adout and Clear ror Data	Error codes are read out and cleared.	●Readout FUN 2 READ ●Clear (after readout) 0 ENTR	54
adout Operating atus	Operating status of the MICRO-1 is read out. Timer/counter preset value modification status is also displayed at the same time.	FUN 3 READ	55
uential Monitor	Program instructions at each address are displayed sequentially and the operating status of I/O, internal relay, shift register, timer or counter at the address is also monitored.	FUN 9 3 READ (Start monitoring) 1 ENTR ADRS Address No. for monitoring READ (End monitoring) 0 ENTR (Note)	63
adout TIM/CNT dified Preset ue Data	When timer/counter preset values are changed during operation, the preset values in the program loader are replaced by the new preset values.	FUN 9 4 READ ENTR	55
r TIM/CNT dified Preset ue Data	The modified timer/counter preset values are cleared and the old timer/counter preset values are restored.	FUN 9 5 READ ENTR	56
r Program Check	The user program is checked at each step. If an error is found, the error code and its address are displayed.	FUN 9 8 READ	57
gram Loader dware Check	The program version of the program loader is displayed, and then the program loader display and internal memory functions are checked.	FUN 9 9 READ	56

: After starting the sequential monitoring using the FUN93 setting, disconnecting the program loader from the base unit, thus turning power OFF, will clear this setting.

Display System Program Version — FUN97

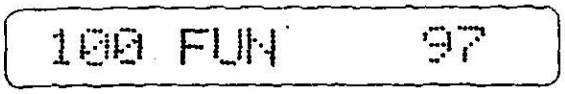
The MICRO-1 system program version is displayed.

Operation

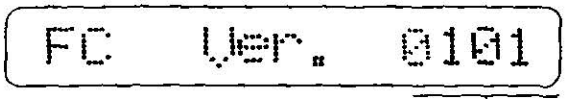
FUN 9 7 READ

- **Key Operation and Display**

FUN 9 7



READ



The version number changes each time the MICRO-1 system program is updated.

Readout and Clear Error Data — FUN2

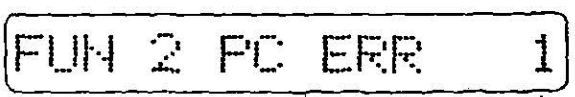
If errors are found in the MICRO-1, the error codes are read out and cleared.

Operation

FUN 2 READ

- **Key Operation and Display**

FUN 2 READ



Error Code

Note 1: When the program loader is not connected to the base unit, the following message is displayed.

(Receive Error)

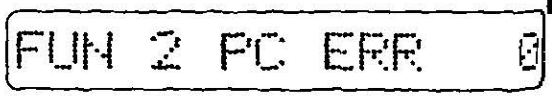
Note 2: If the base unit is out of use for a long period of time, the built-in super capacitor discharges, causing an erroneous display of error data codes. Clear the error data codes after turning power ON.

Clearing Error Data Codes

To clear the display of error data codes, enter 0.

FUN 2 READ

0 ENTR



Note: Entering a number other than 0 will also display the error data code display.

For details of error data codes, see page 71.

Readout Operating Status — FUN3

Operating status of the MICRO-1 is read out.
Timer/counter preset value modification status is also displayed at the same time.

Operation

FUN 3 READ

●Display

```
FUN 3 STOP PC  2
```

RUN: In operation
STOP: In halt

Status Code
No display: T/C preset value is not changed
2: T/C preset value is changed

Supplementary

After reading out the data once, the display does not change even when the operating status changes. Perform the FUN3 readout operation once again.

Readout TIM/CNT Modified Preset Value Data — FUN94

When timer/counter preset values are changed during operation, the preset values in the program loader can be replaced by the new preset values using the FUN94 operation.

Operation

FUN 9 4 READ

```
FUN94 TC CHANGE?
```

Make sure that the preset value data may be replaced. If OK, press ENTR.

ENTR

```
FUN94 TC  P T L
```

Operation is complete.

```
FUN94 TC   END
```

Supplementary

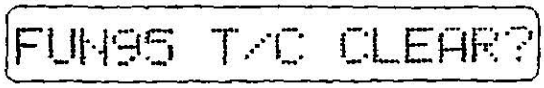
1. Before performing this operation, make sure that the program in execution is the same program as in the program loader.
2. For the procedure to change timer/counter preset values during operation, see page 45.

Clear TIM/CNT Modified Preset Value Data — FUN95

The modified timer/counter preset values are cleared and the old timer/counter preset values are restored.

Operation

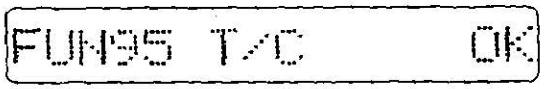
FUN 9 5 READ



Make sure that the modified preset value data may be cleared. If OK, press ENTR.

ENTR

Operation is complete.



Supplementary

When FUN95 is executed, the preset values in the base unit user memory (EEPROM) are written into the base unit RAM.

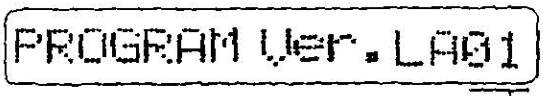
Program Loader Hardware Check — FUN99

The program version of the program loader is displayed, and then the program loader display and internal memory functions are checked.

Operation

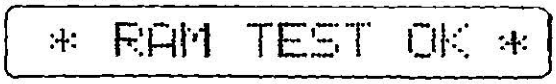
FUN 9 9 READ

●Display



The number changes each time the program version is updated.

When all functions are normal, the following message is displayed at the end.



If an error is found during internal RAM checking, the following message is displayed.

Supplementary

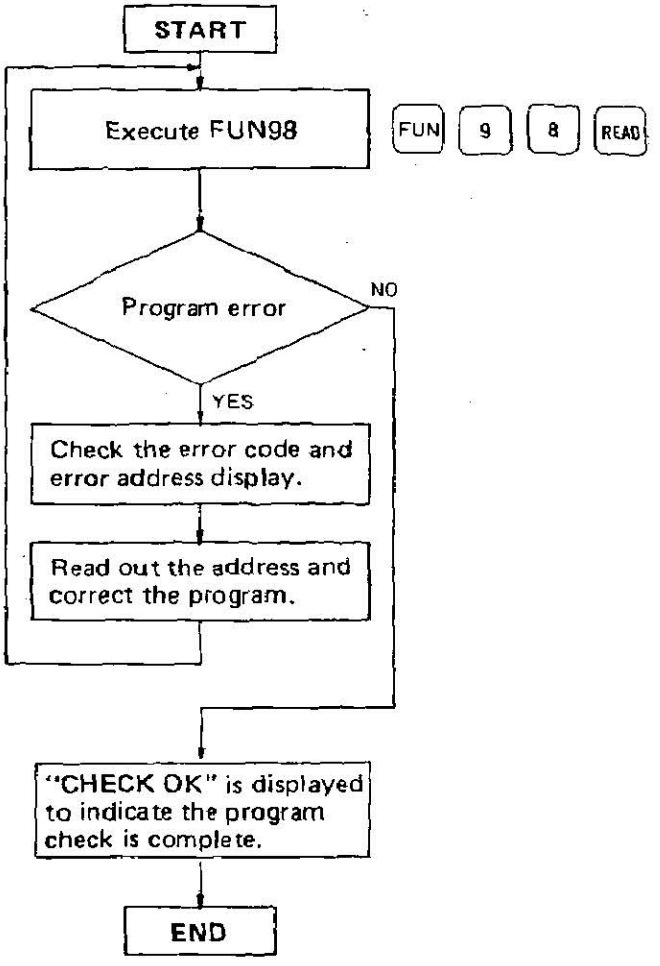
1. Numbers 0 to 9 are displayed sequentially during display checking. Check to see if all numbers are displayed correctly.
2. The internal memory function is checked by reading and writing the entire internal RAM for every 0.5K bytes displaying ▦.

User Program Check — FUN98

The user program is checked at each step. If an error is found, the error code and its address are displayed. Correct the program for every error displayed and repeat the FUN98 operation until a "CHECK OK" is displayed.

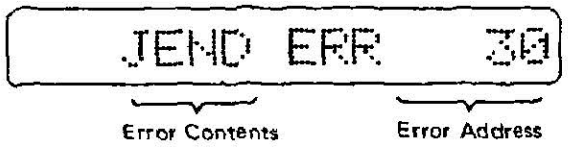
Operation

After entering a user program, check the program using the following procedure.



•Key Operation and Display

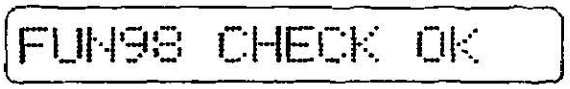
FUN 9 8 READ



Note: The FUN98 operation does not check input and output numbers, therefore after checking a program including I/O numbers over the MICRO-1 I/O allocation, "CHECK OK" is displayed. When such a program is transferred, an error will result and the program cannot be run.

Display Message

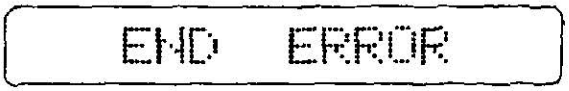
The user program check operation is responded by seven messages.

① 

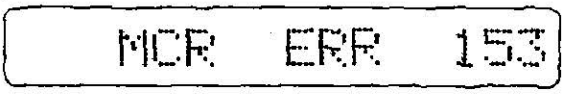
Program check is complete.

② 

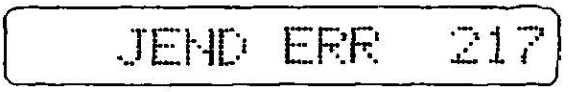
No user program is found.

③ 

END is missing.

④ 

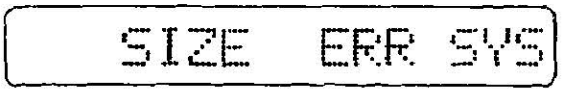
MCS or MCR is missing.

⑤ 

JMP or JEND is missing.

⑥ 

One of a two-address instruction is missing.
The user program is damaged.

⑦ 

The program capacity data is damaged.

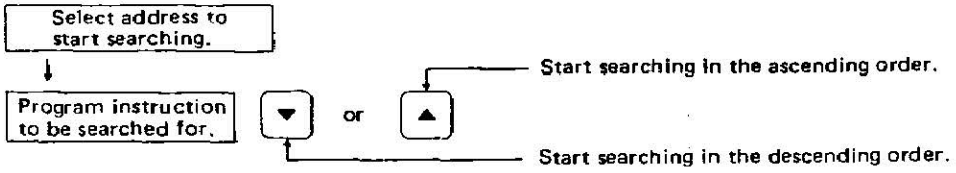
Supplementary

If more than one error is found in a user program, the error at the smallest address is displayed.

6. Search for Program Instruction

The user program in the program loader is searched for a program instruction in the ascending or descending order starting at the current address.

Operation



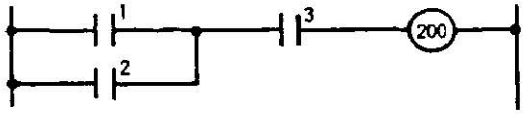
●Key Operation Examples of Searching

[Ex. 1] OUT 2 0 0 ▼

[Ex. 2] AND NOT SHF TIM 8 ▼

Example of Searching

●Relay Circuit



●Program List

Address	Instruction Word	Data
100	LOD	1
101	OR	2
102	AND	3
103	OUT	200

To search for OUT200 in the above circuit.

●Key Operation and Display

ADRS 0 READ Start searching at address 0.

OUT 2 0 0

▼

Supplementary

Only one program instruction is searched for at one time, i.e. when the program instruction is located, the searching ends. To search for another instruction, repeat the procedure from the beginning.

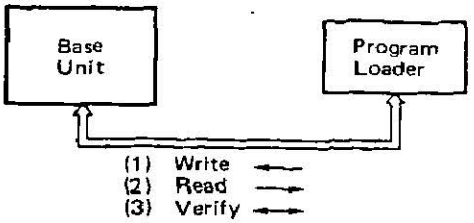
7. Transfer Program

User programs can be transferred between the program loader and the base unit in three ways:

(1) Write Program
Writing a program from the program loader to the base unit.

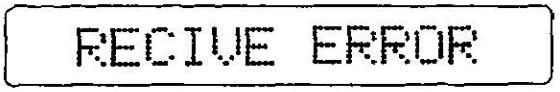
(2) Read Program
Reading a program from the base unit to the program loader.

(3) Verify Program
Verifying programs between the base unit and the program loader.



Note 1: If the program loader is not connected to the base unit, a "Receive Error" will result.

Display



Note 2: If timer/counter preset values have been changed during operation and the user program is written into the base unit without changing the program in the program loader, the program in the program loader replaces the program in the base unit, thus the new timer/counter preset values will be lost.

1 Write Program

This operation is to write a user program from the program loader to the base unit.

Operation

Make sure that the MICRO-1 is in halt before starting the following procedure.

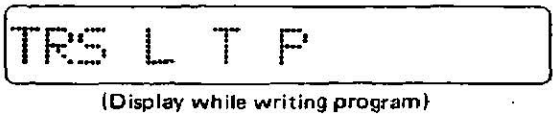
●Key Operation and Display

TRS ENTR

Short for Loader To PLC

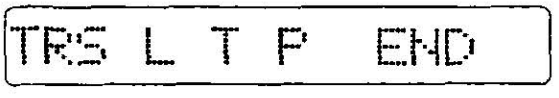
Make sure that the write operation may be executed.

ENTR



(Display while writing program)

Display when operation is complete.

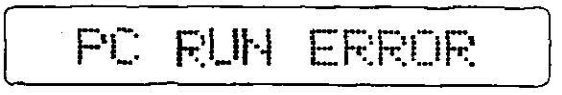


●When the ERROR LED on the base unit goes ON approximately 3 seconds after starting, perform the FUN2 operation (readout and clear error data) to check for the error and take appropriate actions to correct the error.

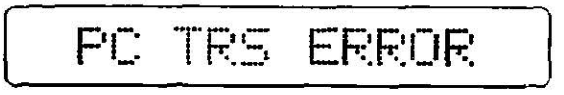
●Program transfer from the program loader to the base unit takes approximately 4.5 seconds.

Error Display

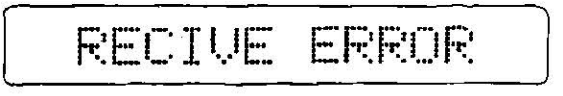
1. When a user program is written into the base unit during MICRO-1 operation, the following error message is displayed.



2. When a communication error other than an abnormal receive command occurs, the following error message is displayed.



3. When an abnormal receive command error occurs in the base unit, the following error message is displayed.



2 Read Program

This operation is to read out a user program from the base unit user memory to the program loader.

Operation

The read program operation can be performed whether the MICRO-1 is in operation or halt.

● Key Operation and Display

TRS READ

TRS P T L GO ?

Short for PLC To Loader

Make sure that the read operation may be executed.

ENTR

TRS P T L

(Display while reading program)

Display when operation is complete.

TRS P T L END

Error Display

1. When the program CRC finds an error, the follo error message is displayed.

CRC ERROR

2. When a communication error occurs, the follo error message is displayed.

RECIVE ERROR

3 Verify Program

This operation is to verify user programs between the base unit and the program loader.

Operation

The verify program operation can be performed whether the MICRO-1 is in operation or halt.

● Key Operation and Display

TRS VERI

TRS L A P GO ?

Short for Loader And PLC

ENTR

TRS L A P

(Display while verifying programs)

Display when operation is complete.

TRS L A P END

Error Display

1. When a communication error occurs, the follo error message is displayed.

RECIVE ERROR

2. When a verify error occurs, the following message is displayed.

TRS L A P ER 2

Error Addr

TRS L A P ER F

FUN Registration Are

MONITORING OPERATION

I/O, timer, counter and shift register operation and also timer/counter counted values can be monitored during operation by simple key operation. Monitoring operation are performed in two ways: simultaneous monitoring and sequential monitoring.

1. Simultaneous Monitoring

The simultaneous monitoring operation includes monitoring of the following items.

(1) I/O status, (2) Timer current value and status, (3) Counter counted value and status, (4) Internal relay status, and (5) Shift register bit status

Supplementary

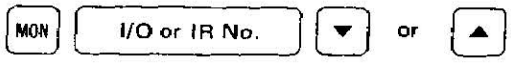
1. Connect the program loader to the base unit to perform monitoring.
2. Pressing the ▼ or ▲ key will allow monitoring of the subsequent or preceding area.
3. Monitored data are updated every 100 msec.
4. To cancel monitoring, press the CLR key.

1 Monitor I/O and Internal Relay

Monitored statuses are displayed in units of 8 points from the specified number.
The monitored status is indicated as follows:

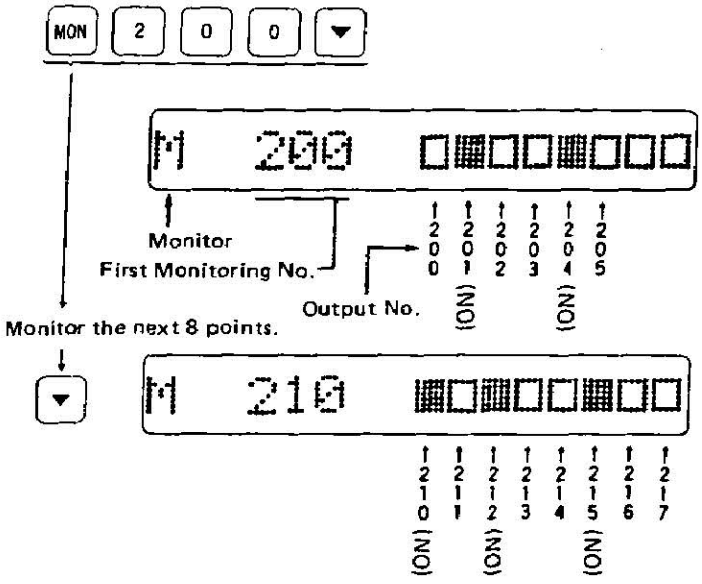
■ indicates ON.
□ indicates OFF.

Operation



●Key Operation and Display

[Ex.] To monitor Output No. 200.

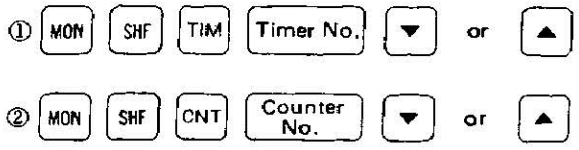


2 Monitor Timer/Counter

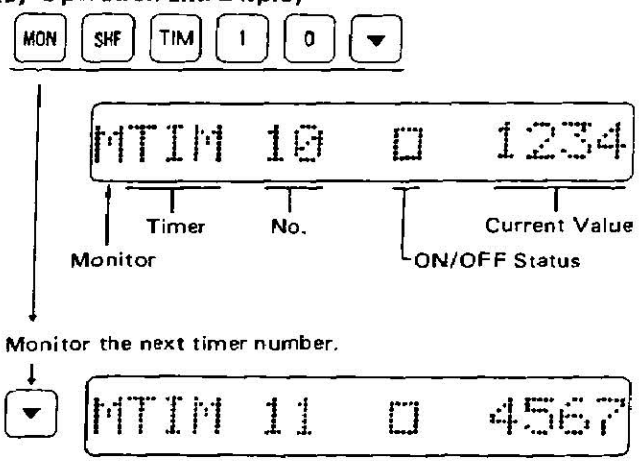
The timer current value is monitored in the subtracting mode and the counter counted value is monitored in the adding mode. The monitor display includes the timer/counter number, ON/OFF status, and the current/counted value.
The monitored timer/counter status is indicated as follows:

■ indicates ON. (Time up or count up)
□ indicates OFF. (Operation in progress or halt)

Operation



●Key Operation and Display



3 Monitor Shift Register

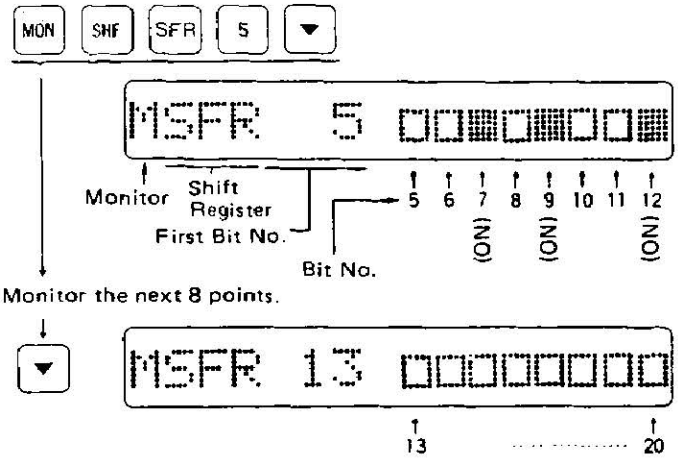
Monitored shift register bit statuses are displayed in units of 8 points from the specified bit number.
The monitored status is indicated as follows:

■ indicates ON.
□ indicates OFF.

Operation

MON SHF SFR Bit No. ▲ or ▼

● Key Operation and Display



2. Sequential Monitoring

(1) The sequential monitoring operation is performed by using FUN93 and allows monitoring of the operating status of an I/O, internal relay, shift register, timer or counter at each address sequentially.

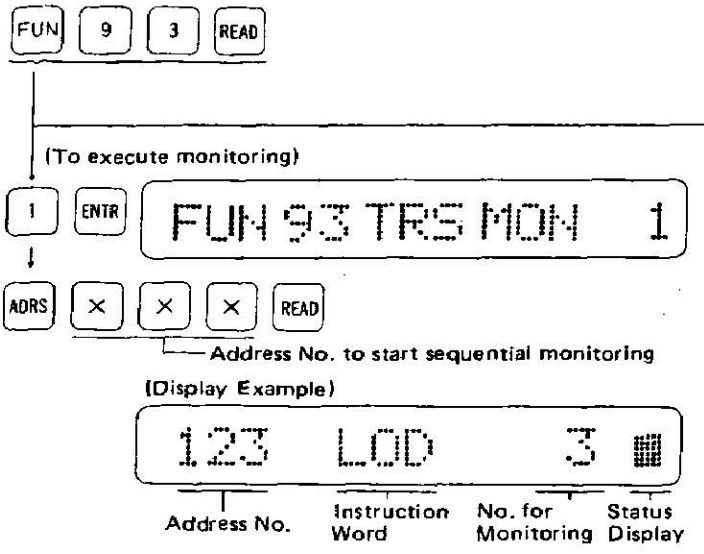
(2) The sequential monitoring operation can be performed at each address containing a LOD, AND, OR, OUT, SET, RST, TIM or CNT instruction.

(3) The monitored status is indicated as follows:
- ●I/O, IR or SFR
  - ■: ON
  - □: OFF
  - No display: Cannot communicate or perform monitoring at the address or instruction.
- ●Timer or Counter
  - ■: ON (Time up or count up)
  - □: OFF (Operation in progress or halt)
  - No display: Cannot communicate or perform monitoring at the address or instruction.

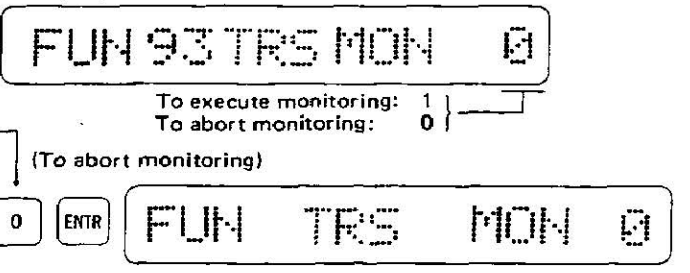
Note: Where a NOT instruction is included, the display is reversed.

Operation

●Key Operation



●Display



(Display Example)

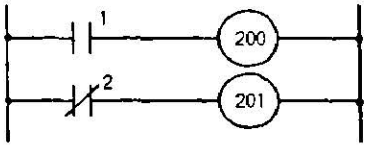
The above display example indicates that Input 3 of LOD instruction at Address 123 is ON.
The subsequent or preceding address can be monitored simply by pressing the ▼ or ▲ key.
Unless the sequential monitoring is canceled, selecting another address will execute monitoring the selected address continuously.

Supplementary

With FUN93 set to 1, instruction keys are valid.

Note: After starting the sequential monitoring using the FUN93 setting, disconnecting the program loader from the base unit, thus turning power OFF, will clear this setting.

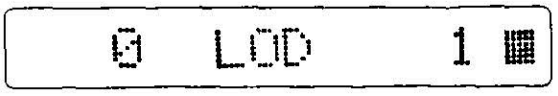
[Ex.]



Address	Instruction Word	Data
0	LOD	1
1	OUT	200
2	LOD NOT	2
3	OUT	201

When sequential monitoring is executed for Addresses 0 and 2 of the above program, the display will appear as shown below.

Address 0



..... indicates that Input 1 is ON.

Address 2

..... indicates that Input 2 is OFF.

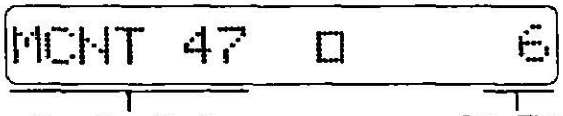
3. Scan Time Monitoring

The scan time for the user program written in the MICRO-1 base unit can be read out.

Operation

- **Key Operation and Display**

MON SHF CNT 4 7 READ



Scan Time Monitor

Scan Time (msec)

Instruction Execution Time

Instruction Word	Operand	Maximum Time (μsec)	Compilation Bytes
END		4000	3
LOD	IN, OUT, IR	9.7	12
AND	IN, OUT, IR	5.5	5
OR	IN, OUT, IR	7.6	7
OUT	OUT, IR	9.7	9
SET	SFR, OUT, IR	8.6	8
RST	SFR, OUT, IR	8.6	8
LOD N	IN, OUT, IR	10.8	13
AND N	IN, OUT, IR	5.5	5
OR N	IN, OUT, IR	7.6	7
LOD	T	10.8	12
LOD	C	9.7	12
LOD	R	8.6	12
OR-LOD		5.5	7
AND-LOD		5.5	7
SOT		45.2	8
MCS		12	3
MCR		10	3
JMP		13.3	3
JEND		11	3

nstruction Word	Number, etc.	Maximum Time (μsec)	Average Time (μsec)	Compilation Byte
IM	0 to 79	129	106	5
NT	0 to 44	104	93	5
CNT	45 to 46	96	80	5
SFR(N)	n bits	(Note)	141	9
FUN100		43		9
FUN200		43		9

Note: The execution time varies with the number of shift bits.

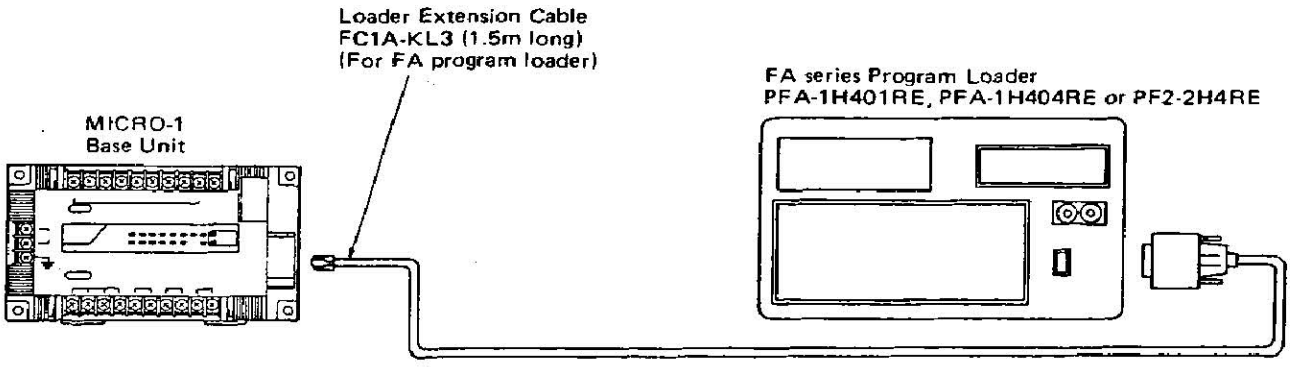
8 points	186 μsec
64 points	287 μsec
128 points	391 μsec

CONNECTION TO FA SERIES PLC

1. Connecting FA Series Program Loader to MICRO-1 Base Unit

(Cable Connection)

The FA series program loader PFA-1H401RE, PFA-1H404RE or PF2-2H4RE can be connected to the MICRO-1 base unit using the optional loader extension cable FC1A-KL3 as shown below.

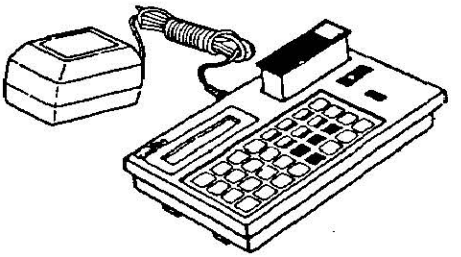


The FA series program loader can be used for programming the MICRO-1 user programs by connecting the program loader as illustrated above, then the following must be taken into consideration.

- The FA series program loader can make programs of the maximum program capacity and computing instructions of the FA series programmable controllers. The MICRO-1, however, can run programs within the maximum program capacity and instruction words of the MICRO-1.
- When a program exceeding the MICRO-1 capability is transferred from the FA series program loader to the MICRO-1 base unit, an error will result.
- Program capacity of the 4K-step program loader must be set to 1K steps. When transferring a program from the FA series program loader with 4K-step capacity selected, error 200 will be displayed. Then, select 1K-step program capacity by pressing the FUN, 1, READ, 1, and ENTR keys on the program loader.

MICRO-1 user programs can be stored in memory packs for the FA series using the following procedure.

- Connect the FA series program loader to the MICRO-1 base unit and read out the program to the FA series program loader using the transfer program operation.
- When readout is complete, disconnect the loader extension cable and connect an AC adapter to supply power to the program loader. Install a memory pack PFA-1M14 (EEPROM) or PFA-1M34 (EPROM) into the program loader.



- Transfer the program from the program loader to the memory pack using the PROM writing operation. The program can be stored in the memory pack. For details of memory packs, readout program, and PROM writing operation, see the FA series programmable controller users manual.

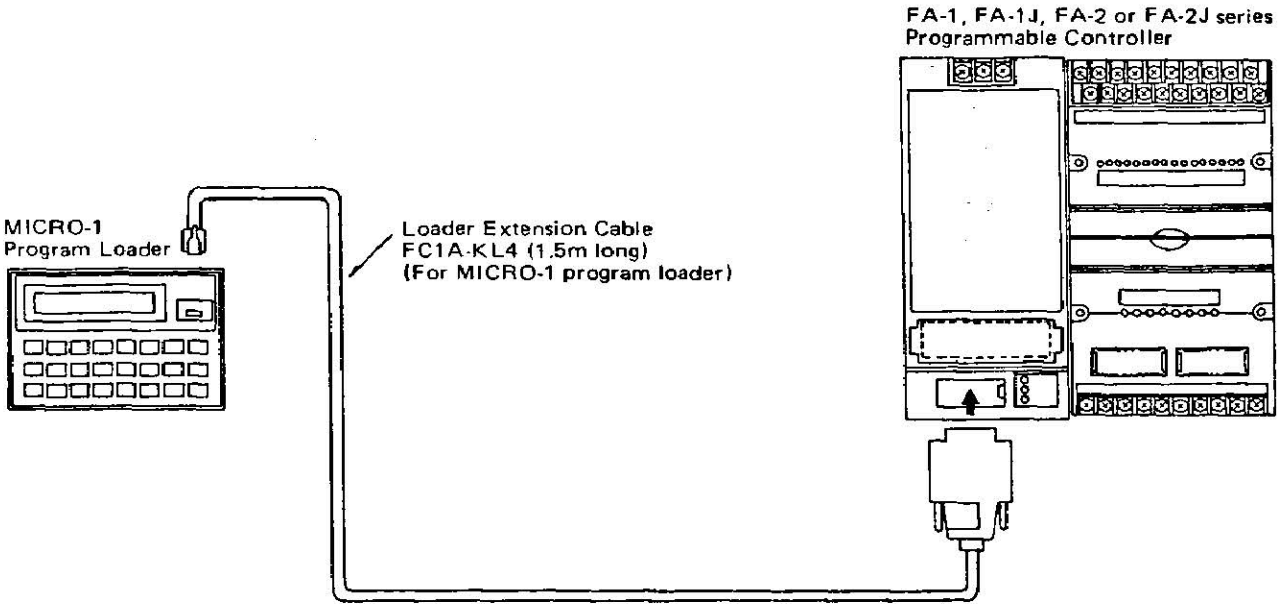
CAUTION

If PROM writing operation is performed with the loader extension cable connected to the MICRO-1 base unit without using an AC adapter, both the MICRO-1 base unit and program loader will malfunction.

2. Connecting MICRO-1 Program Loader to FA Series CPU

(Cable Connection)

The MICRO-1 program loader FC1A-HL1E can be connected to the FA series programmable controller CPU using the optional loader extension cable FC1A-KL4 as shown below.



The MICRO-1 program loader can be used for programming user programs for the FA series programmable controllers by connecting the program loader as illustrated above, then the following must be taken into consideration.

Supplementary

Programming for the FA series programmable controller using the MICRO-1 program loader.

1. The following can be programmed:
   - Program of 0 to 963 steps (1K steps)
   - FA series instruction words (except 2. listed below)
   - Inputs and outputs within the range of the FA series
   - Addressed jump instruction (FUN300)
2. The following cannot be programmed:
   - Computing instructions (FUN147 and FUN247)
   - CNT FUN instruction (for FA-1)
   - FUN1, FUN10 to FUN21, FUN36 to FUN59, and FUN96 settings
   - Program capacity (FUN1 is fixed at 1K steps)

INSTALLATION & WIRING

nstallation and wiring operations should be carried out with due consideration taken for operating convenience, aintainability and resistance to the environment so that the MICRO-1 can perform at full capacity.

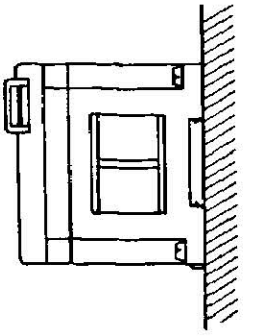
. Installation Location

) Avoid installing the MICRO-1 in the following locations.

Where ambient temperature drops below 0°C or exceeds +55°C.
Where ambient humidity drops below 45% or exceeds 85% RH.
Where the MICRO-1 is exposed to large amounts of dust, salt, iron powder, etc.
Where the MICRO-1 is exposed to direct sunlight.
Where the MICRO-1 is subject to vibrations or shocks.
Where corrosive or flammable gas is present.

lote: If any wire chips or metal chips fall into the MICRO-1 housing, malfunction may result. To prevent such object from entering the MICRO-1 during installation work, place a cover over the ventilation holes on top of the MICRO-1.

(2) Keep sufficient spaces from surrounding fixtures and heating objects to ensure good ventilation. Always install the MICRO-1 horizontally along a vertical surface as illustrated below.

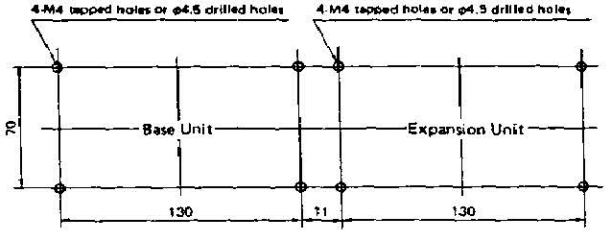


2. Mounting

The MICRO-1 base and expansion units can be mounted on a panel and a 35mm-wide DIN rail.

Panel Mounting

Mounting hole layout for MICRO-1 panel mounting is shown below.



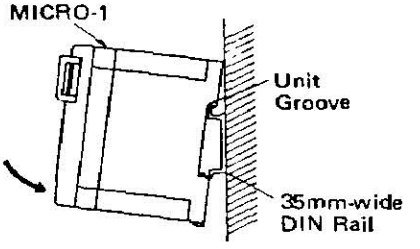
35mm-wide DIN Rail Mounting

The MICRO-1 base unit can be mounted on a 35mm-wide DIN rail available from IDEC.

Applicable DIN Rail: Type BAA500 (500 mm long)
Type BAA1000 (1000 mm long)

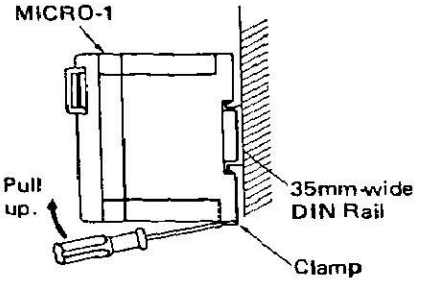
(Mounting on DIN Rail)

(1) Fasten the DIN rail to the mounting plate firmly using screws.
(2) When installing the MICRO-1 base or expansion unit on a DIN rail, as illustrated below, with the input terminal side up, put the groove on the rail and press the unit in the direction of the arrow.



(Removing from DIN Rail)

As illustrated below, insert a flat screwdriver into the slot in the clamp, pull the screwdriver up and turn the MICRO-1 unit bottom out.



I/O Expansion Cable

When using an expansion unit, connect the expansion unit to the base unit using an I/O expansion cable. I/O expansion cable FC1A-KE1 (40mm long) is attached to an expansion unit for close mounting of the base and expansion units. For separate mounting of the base and expansion units, longer I/O expansion cables are optionally available: PFA-1A21 (500mm long), PFA-1A22 (750mm long), and PFA-1A23 (1m long). These long I/O expansion cables have a shield terminal but the shield terminal need not be connected to any terminal. Cut off the shield terminal from the I/O expansion cable.

3. Wiring

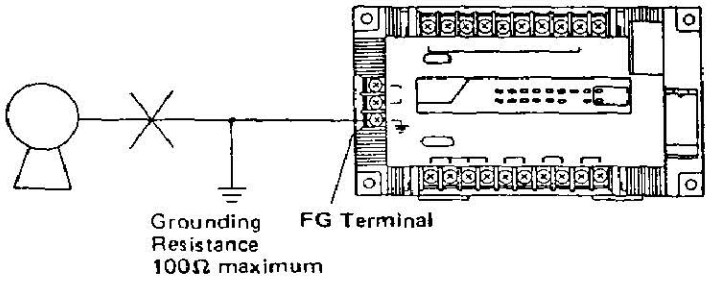
Power, input and output terminals are M3 screws. Tightening torque is 0.5 N-m (approx. 5 kgf-cm) maximum.

(1) Power Supply Wiring

- Use stranded wires of 1.25 mm² and make the wiring as short as possible.
- Keep the power supply line away from motor lines.

(To prevent electric shocks and malfunction due to noise, make sure of the following.)

- Ground the FG terminal (grounding resistance 100Ω or less).
- Do not connect the grounding wire to the grounding wire for motor equipment.
- Use a wire of 2mm² or more for the grounding wire.

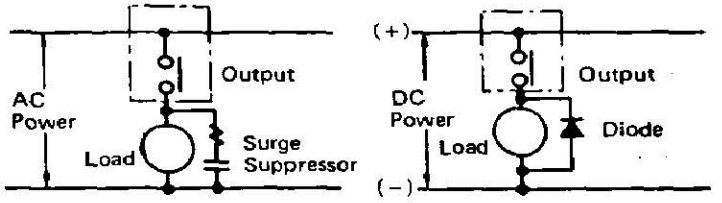


(2) Input Wiring

- Separate the input wiring from the output line, power supply line, and motor line.
- Use wires of 0.75 to 1.25mm² for input wiring. (M3 screw terminal)

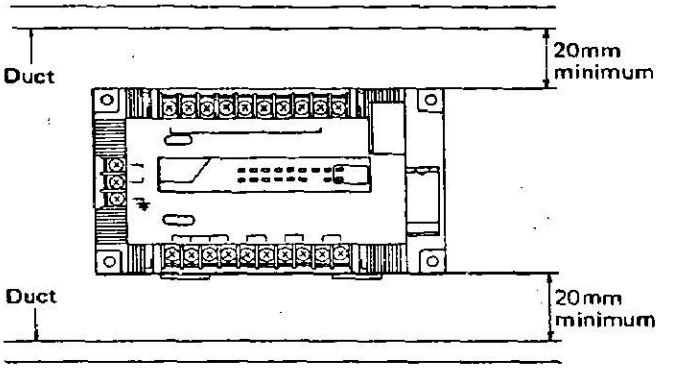
(3) Output Wiring

- When driving a load involving an electromagnet or solenoid valve which generates noise, it is recommended to use a surge suppressor for AC power or a diode for DC power.
- Use wires of 0.75 to 1.25mm² for output wiring. (M3 screw terminal)



(4) Wiring Duct

When wiring input and output lines in ducts, keep at least 20mm between the MICRO-1 unit and the duct to allow for easy maintenance.



(5) Power Supply

- The applicable power voltage range for the MICRO-1 is 85 to 264V AC or 19.2 to 28.8V DC.

(Power OFF)

- The power failure voltage varies with the operating conditions of the program loader and the number of I/O points. Basically, when the power voltage drops below 85V AC or 18V DC, power failure is detected, stopping operation to prevent malfunctioning.
- Momentary power failure of 50msec or less is not detected.

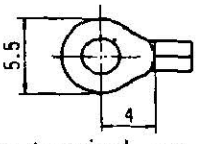
(Inrush Current When Turning Power ON)

When the MICRO-1 base unit is turned ON, the following inrush current flows:

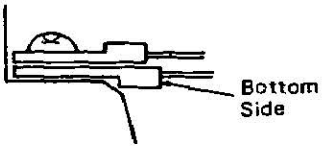
- AC Type: 30A maximum (at 264V AC, maximum load)
- DC Type: 30A maximum (at 28.8V DC, maximum load)

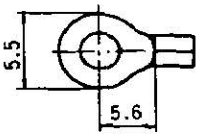
(6) Crimping Terminal

- When connecting one wire to one terminal, the crimping terminal shown at right can be used.



- Only when connecting two wires to one terminal, use the crimping terminal shown below on the bottom side.

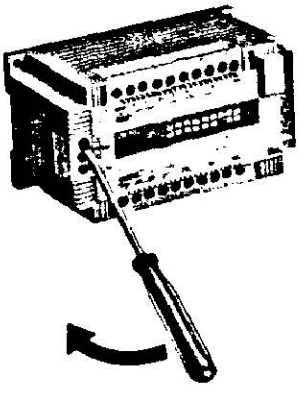




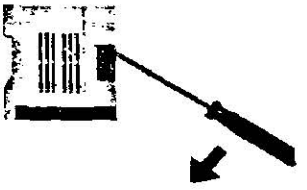
4. Removing Terminal Cover

Finger protection terminal covers are attached to all terminal blocks. When wiring, remove the cover as shown at right.

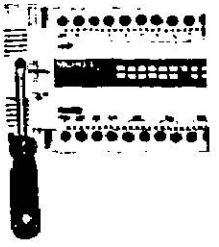
- Insert the tip of a flat screwdriver diagonally into the the round hole at the end of the terminal cover and disengage the latch by pulling up the tip of the screwdriver.
- Use a flat screwdriver with a tip that can be inserted into the terminal cover hole of 4 mm dia.
- When two or three fingers can be inserted under the terminal cover, the terminal cover can be removed with fingers by pulling the terminal cover out.



- Side View

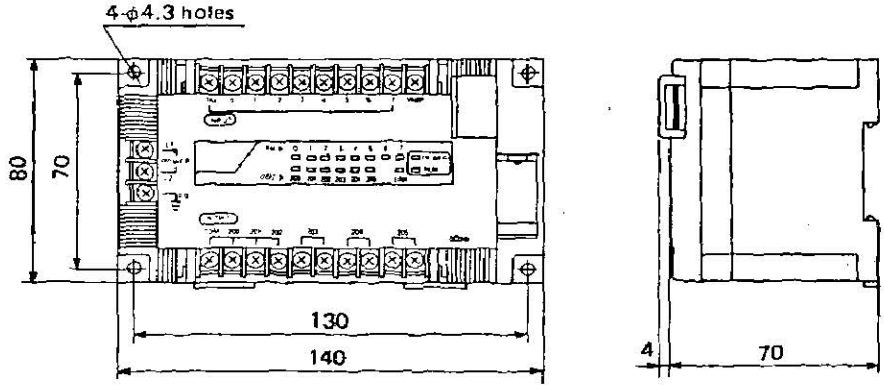


- Front View

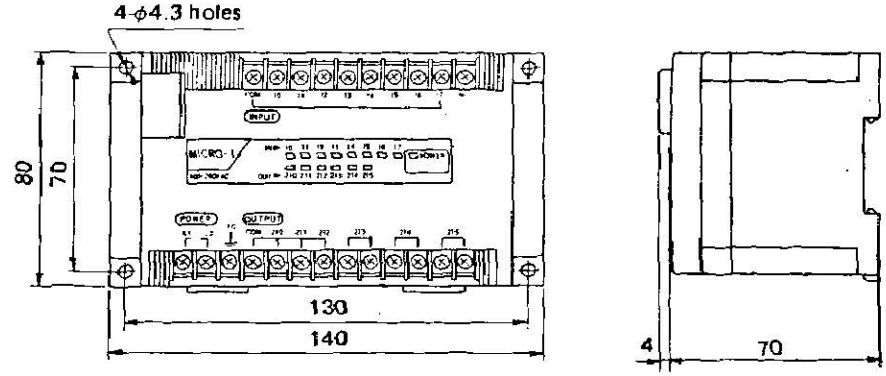


DIMENSIONS

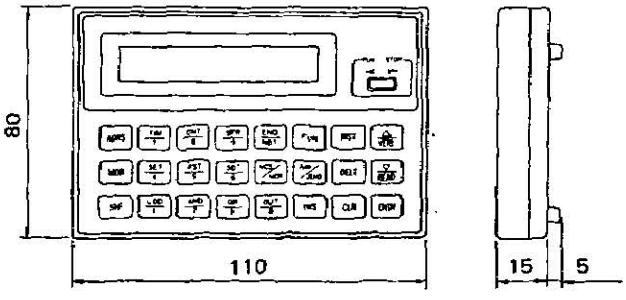
1. Base Unit



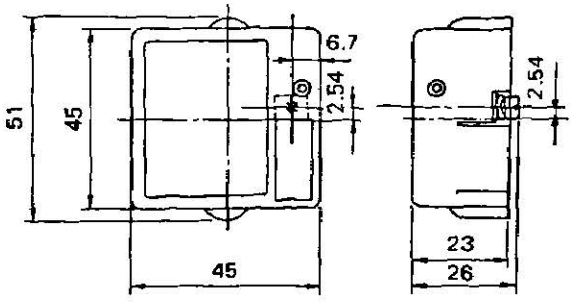
2. Expansion Unit



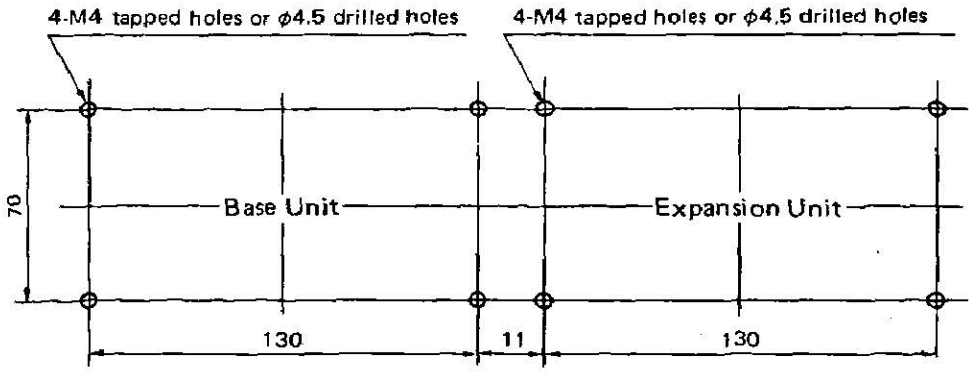
3. Program Loader



4. Serial I/O Module



5. Mounting Hole Layout



All dimensions in mm.

DIAGNOSTIC FUNCTIONS & MAINTENANCE

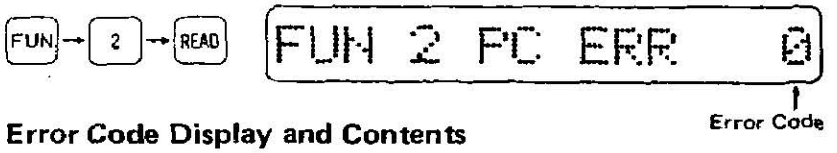
The MICRO-1 has various diagnostic functions to ensure safety if any trouble should occur.
When the ERROR LED on the base unit goes ON, check the following.

Cause	Remedy
1. Low power voltage	When the power voltage is lower than the specified value, the ERROR LED on the base unit goes ON, stopping the MICRO-1 operation. Apply the rated power voltage.
2. Memory check error	When the memory check function detects a temporary error, the ERROR LED goes ON. Such a temporary error is cleared automatically and the ERROR LED goes OFF. An error code is stored and can be read out as a warning signal.
3. System program error	When a trouble is detected in the system program, the base unit must be replaced.
4. User program error	When the user program is incorrect, correct the program using the program loader. The ERROR LED will go OFF.
5. User program writing error	When program writing is incomplete in the program transfer operation from the program loader to the base unit, the base unit must be replaced.

1. Error Codes

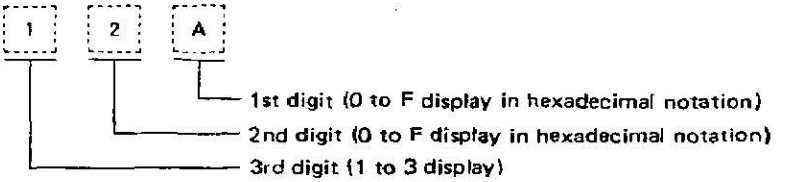
Error data can be checked by the following procedure.

•Key Operation •Display



1) Error Code Display and Contents

Error codes are displayed in a maximum of three digits of hexadecimal codes consisting of four items each in the fist and second digits and two items in the third digit.



2) List of Error Codes

Third Digit Error Codes

Error Code Display \ Error Item	Unused	Unused	User Program Writing Error	System Program Error
0				
1				●
2			●	
3			●	●
4				
5				
6				
7				
8				
9				
A				
B				
C				
D				
E				
F				

Second Digit Error Codes

Error Code Display \ Error Item	User Program Syntax Error	Keep Data Sum Check Error	Program Sum Check Error	TIM/CNT Preset Value CRC Error
0				
1				●
2			●	
3			●	●
4		●		
5		●		●
6		●	●	
7		●	●	●
8	●			
9	●			●
A	●		●	
B	●		●	●
C	●	●		
D	●	●		●
E	●	●	●	
F	●	●	●	●

First Digit Error Codes

Error Code Display \ Error Item	User Program CRC Error	CRC Comparison Code Keep Error	WDT Error	Power Failure
0				
1				●
2			●	
3			●	●
4		●		
5		●		●
6		●	●	
7		●	●	●
8	●			
9	●			●
A	●		●	
B	●		●	●
C	●	●		
D	●	●		●
E	●	●	●	
F	●	●	●	●

Each error code display indicates that the error marked with ● has occurred. Two or more ● marks indicate that multiple errors have occurred at the same time.

Note: FUN2 operation can read out the error data codes stored in the base unit. Since the error data code display does not update automatically, FUN2 operation must be performed again to read out the latest error data.

(3) Error Items and Operating Statuses

	Error Items		Error Code	Operating Status	Output	ERROR LED	Checking performed
①	Power failure		1st digit: 1	Stop	OFF	ON only during error	In every scan
②	WDT error (CPU operation error)		1st digit: 2	Stop	OFF	OFF	In every scan
③	CRC comparison code keep error	Memory Diagnosis	1st digit: 4	RUN	Maintained	OFF	At start
④	User program CRC error		1st digit: 8	Stop	OFF	ON	At start
⑤	TIM/CNT preset value CRC error		2nd digit: 1	RUN	Maintained	OFF	At start
⑥	Program sum check error		2nd digit: 2	Stop	OFF	ON	In every scan
⑦	Keep data sum check error		2nd digit: 4	RUN	Maintained	OFF	When turning power ON
⑧	User program syntax error		2nd digit: 8	Stop	OFF	ON	When writing program
⑨	System program error		3rd digit: 1	Stop	OFF	ON	In every scan
⑩	User program writing error		3rd digit: 2	Stop	OFF	ON	When writing program

(4) Error Description and Corrective Action

① Power Failure
This error is detected when the power voltage is lower than the rated power voltage.

Action:
Supply the rated power voltage.

② WDT Error (Watchdog Timer Error)
The watchdog timer monitors the time required for one program cycle to detect abnormal repeating operation functions, and announces an alarm if the processing is not complete in a specific period of time.

Action:
If the error is temporary, the system program restarts operation automatically. If the MICRO-1 does not restart operation, the base unit must be replaced.

③ CRC Comparison Code Keep Error
This error is detected when the contents of the user program CRC comparison codes in the base unit RAM have changed during a power failure.

Action:
No particular action is required because the system program restores operation automatically. An error data code is stored as an alarm signal.

④ User Program CRC Error
On starting operation, the CRC is executed on the user program to verify with the stored CRC comparison codes. Discrepancy results in a CRC error.

Action:
Transfer a correct program from the program loader. The ERROR LED will go OFF when the program transfer is complete.

⑤ Timer/Counter Preset Value CRC Error
On starting operation, the CRC is executed on the timer/counter preset value data stored in the base unit RAM to verify with the stored CRC comparison codes. Discrepancy results in a CRC error.

Action:
Clear the modified timer/counter preset value data using the program loader (FUN95).

⑥ Program Sum Check Error
This error is detected when an error occurs during executing the user program.

Action:
The system program resets this error automatically. The ERROR LED remains ON. To turn the ERROR LED OFF, reset the error code by pressing the FUN, 2, READ, 0 and ENTR keys on the program loader.

⑦ Keep Data Sum Check Error
If timer/counter data or internal relay ON/OFF statuses stored in the base unit RAM have changed during a power failure, this error is detected when power is restored.

Action:
The system program resets this error automatically. An error data code is stored as an alarm signal. If the power failure duration is much shorter than three days yet this error occurs, the base unit must be replaced.

⑧ User Program Syntax Error
This error occurs when a syntax error is found in the user program.

Action:
Correct the user program using the program loader and transfer the corrected program to the base unit. For details of syntax errors, see the syntax error list on page 71. When the transferred program is correct, the ERROR LED goes OFF.

⑨ System Program Error
This error is detected when the system program is damaged.

Action:
Replace the base unit.

⑩ User Program Writing Error
This error is detected when the user program is not correctly written into the base unit memory during program transfer.
In addition, this error is also detected when a memory size other than 1K steps is selected using the FA series program loader.

Action:
Replace the base unit.
When the selected memory size is not 1K steps correct the memory size selection in the program loader by pressing keys FUN, 1, READ, 1, ENTR.

Supplementary

Error codes other than ⑧ user program syntax error a maintained until cleared by FUN2 operation.

2. Reading Out Error Contents

When ERR80 occurs, the error contents can be read out to the program loader display by the following procedure.

Key Operation

MON → SHF → CNT → READ

●Display

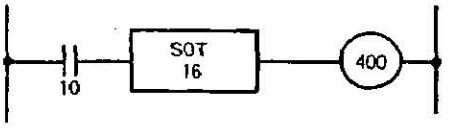
Error Code Display

Syntax Error List

Error Code	Error Details	
10004	Stop input No. setting error (FUN4)	
10005	Reset input No. setting error (FUN5)	
10032	Timer/counter external display operand No. setting error (FUN32)	
10034	Key matrix scan input No. setting error (FUN34)	
10035	Timer/counter external display latch phase setting error (FUN35)	
10060	Computer link system device No. setting error (FUN60)	
( ) 0 to 4035 Adjacent address with an improper instruction word is displayed. (Note)	(2) Improper operation code	Detected when turning power ON or when changing program.
	(3) Improper operand	
	(4) Improper timer/counter data	
	(5) Computing instruction operation code setting error	
	(6) Unused	
	(7) Program over	

Supplementary

Operation codes and operands in the following sample program:
- Operation codes are LOD, SOT and OUT.
- Operands are 10, 16, and 400.

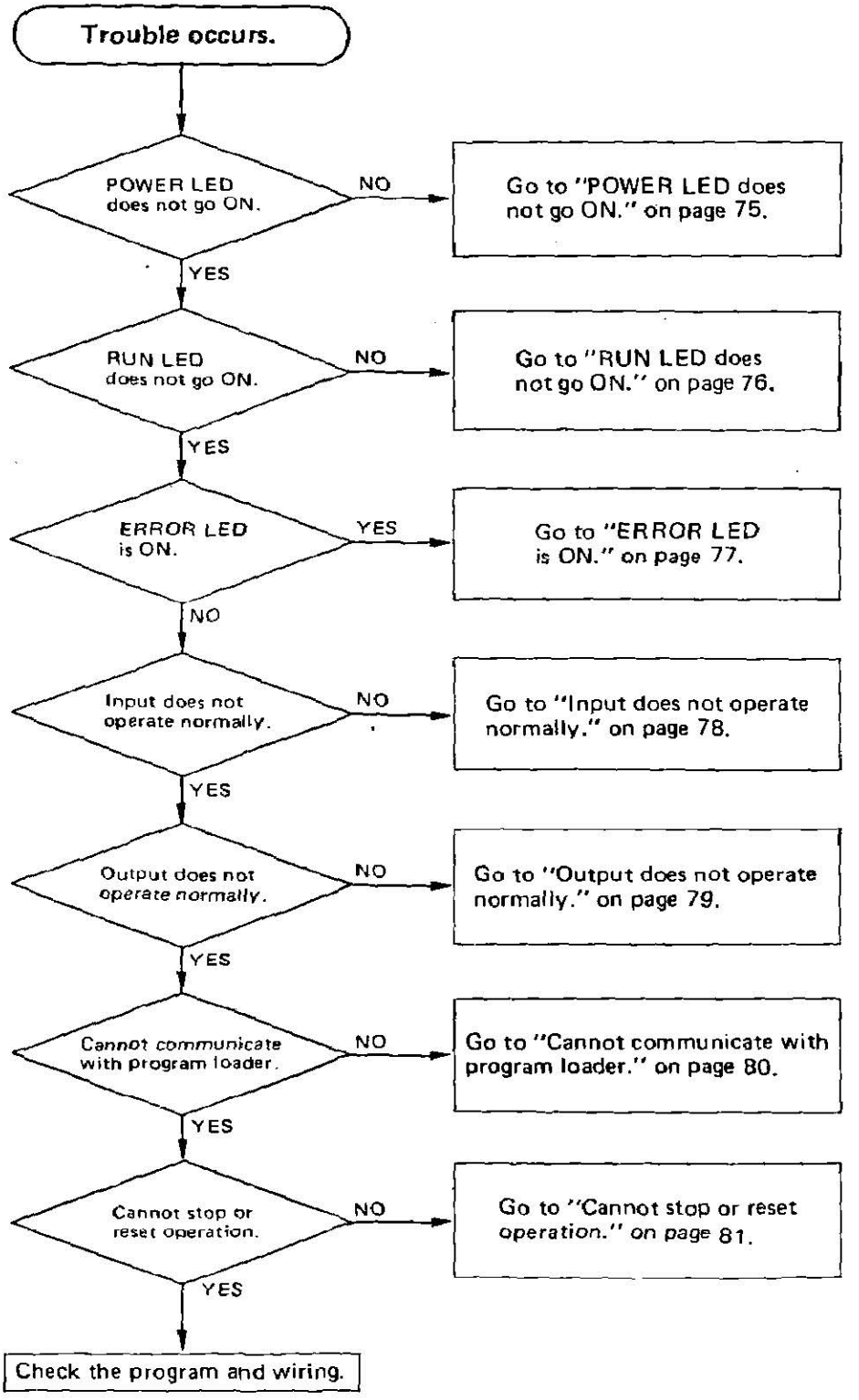


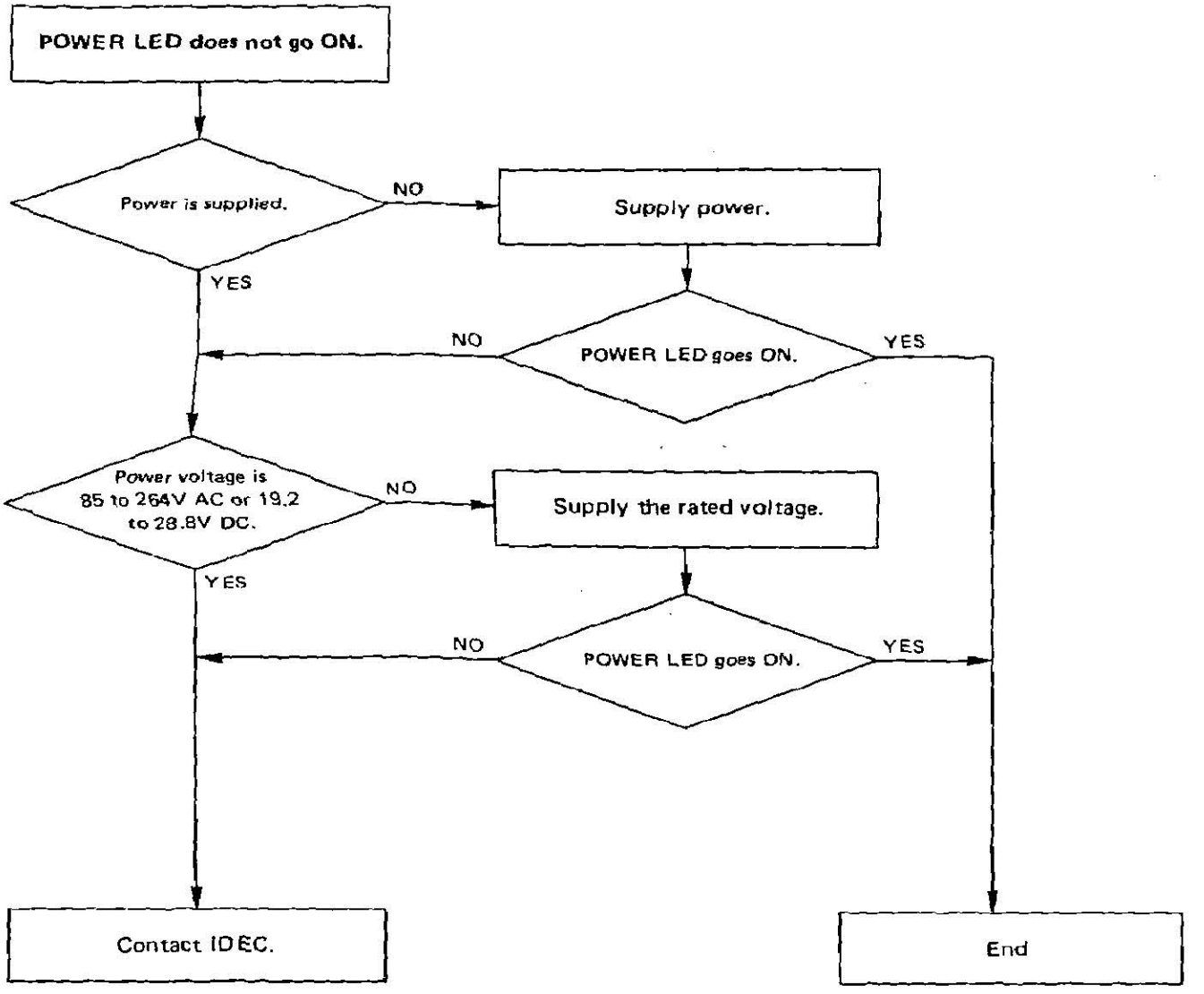
Program
LOD 10
SOT 16
OUT 400

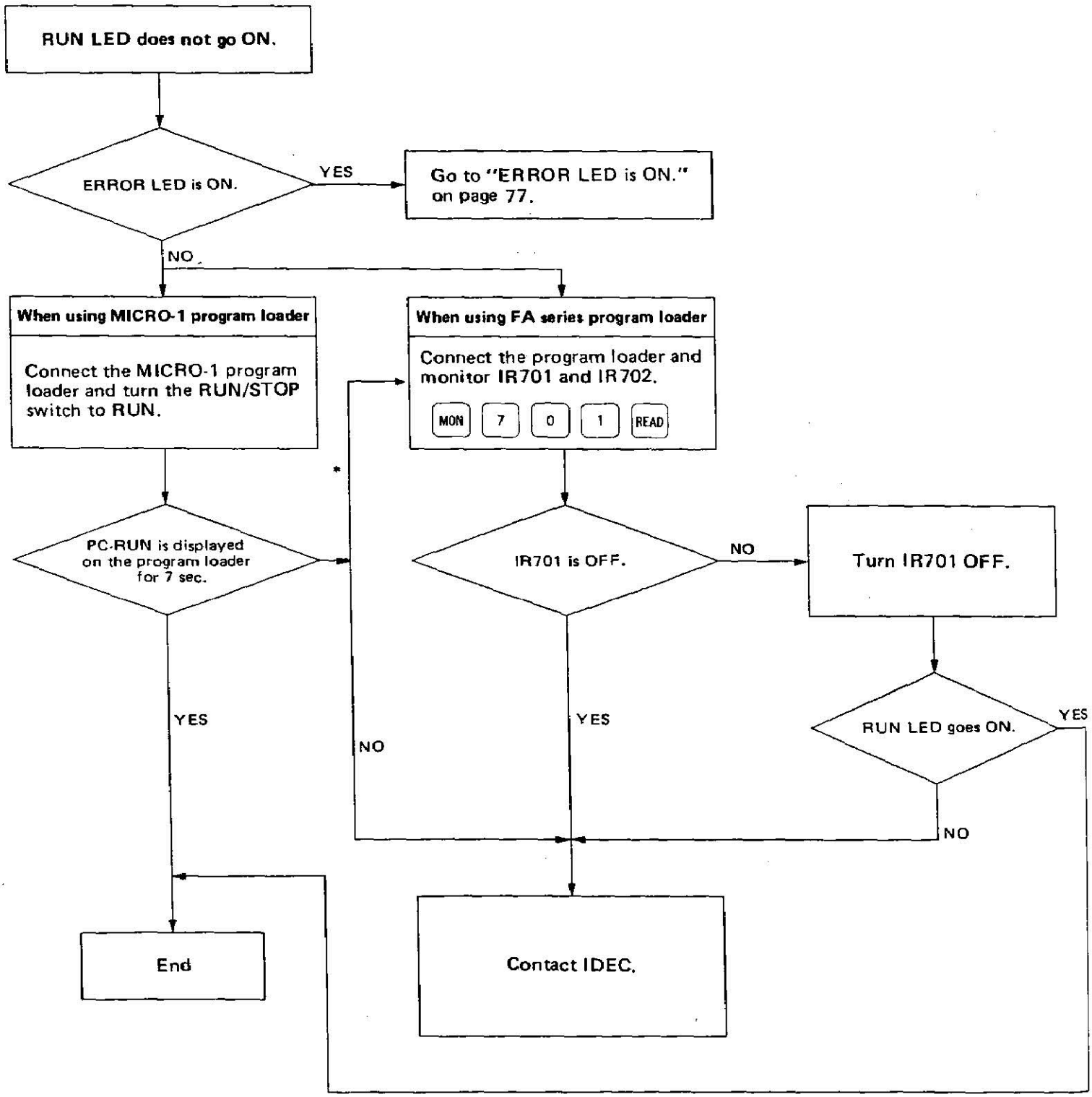
Note: For example, when error code 20126 is displayed, this error code indicates that (2) Improper operation code occurs around Address 0126.

TROUBLESHOOTING PROCEDURES

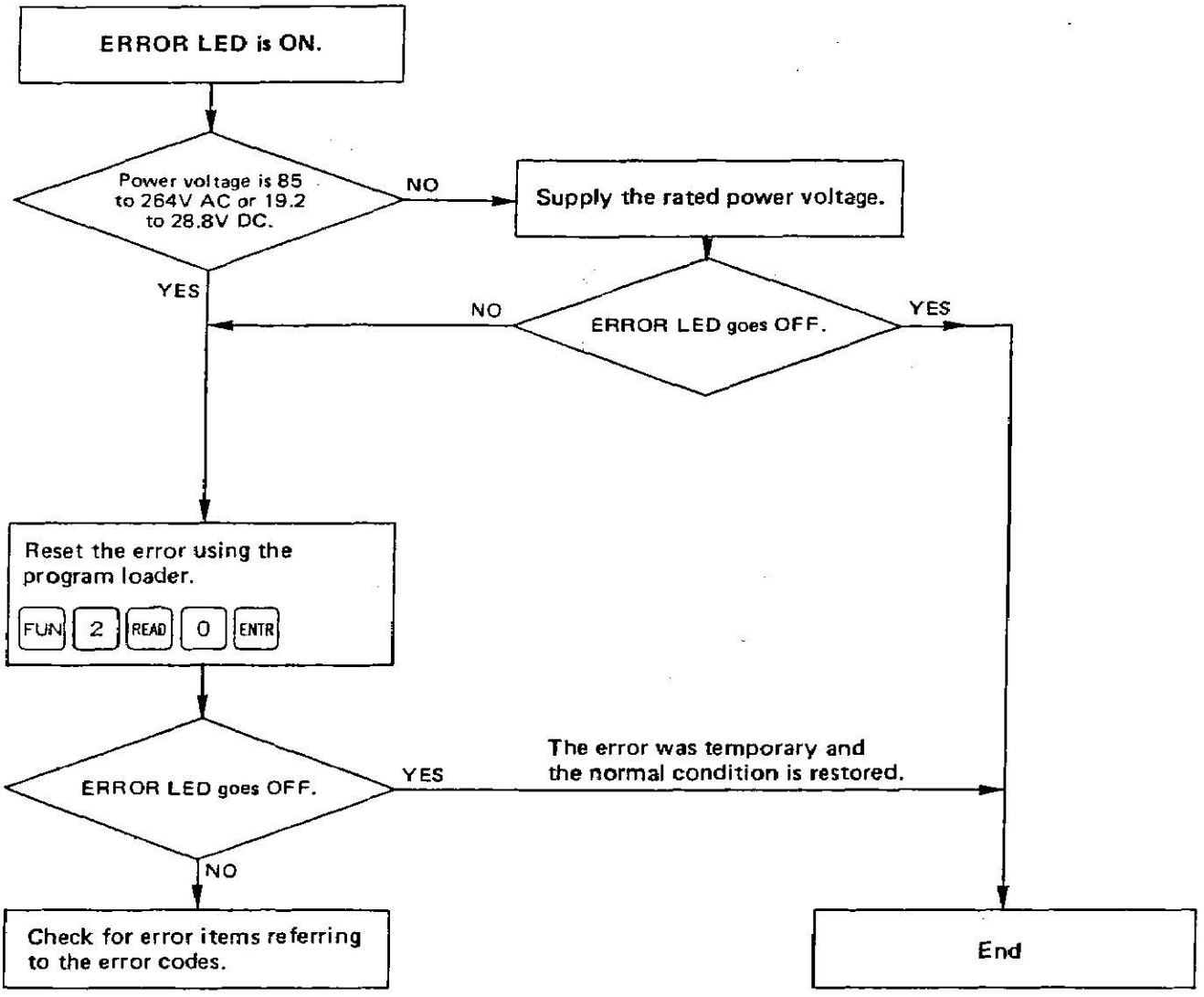
The MICRO-1 has various diagnostic functions to ensure safety if any trouble should occur.
This chapter describes troubleshooting procedures.



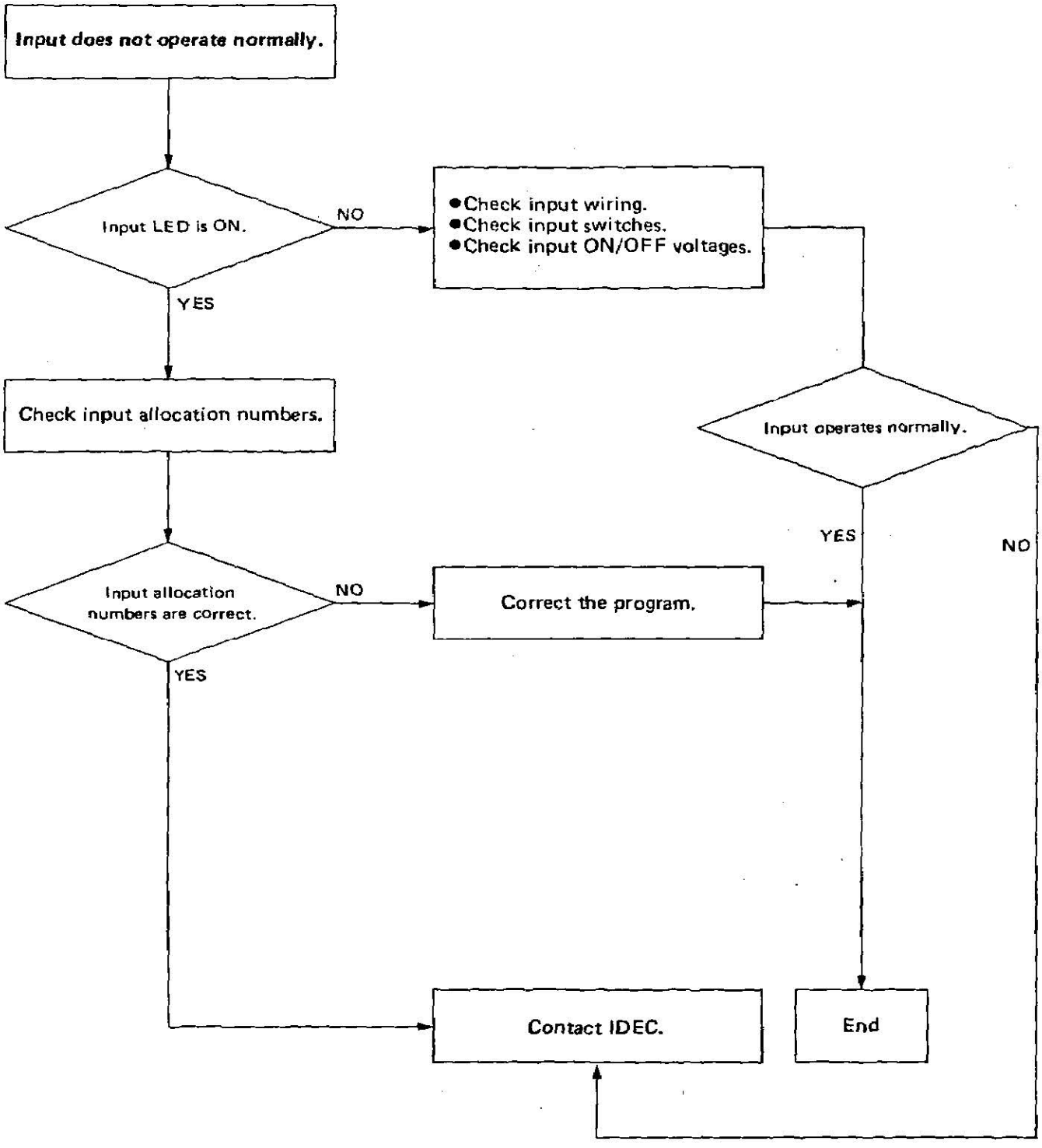

POWER LED does not go ON.
Power is supplied.
NO
Supply power.
YES
NO
POWER LED goes ON.
YES
Power voltage is 85 to 264V AC or 19.2 to 28.8V DC.
NO
Supply the rated voltage.
YES
NO
POWER LED goes ON.
YES
Contact IDEC.
End

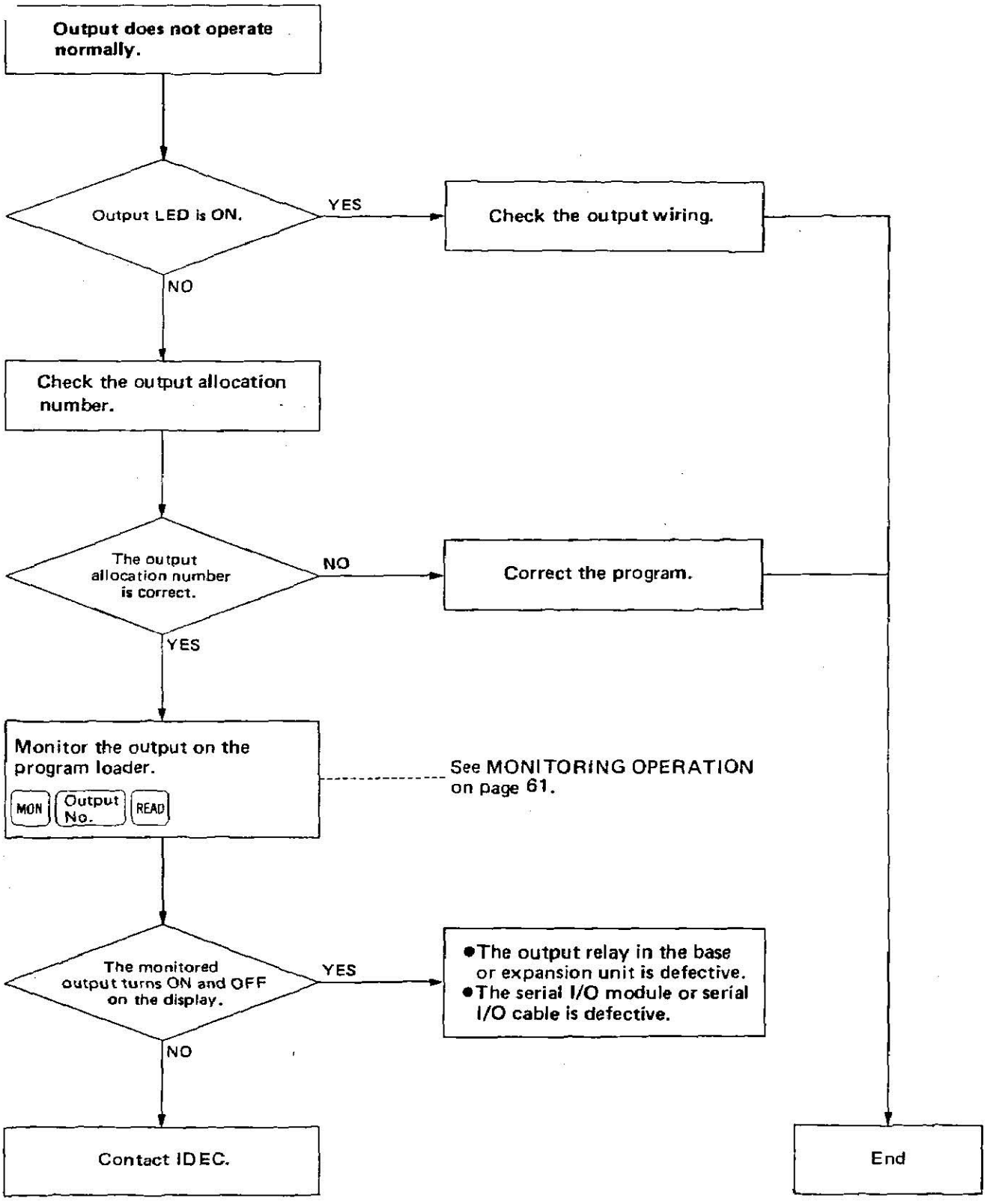


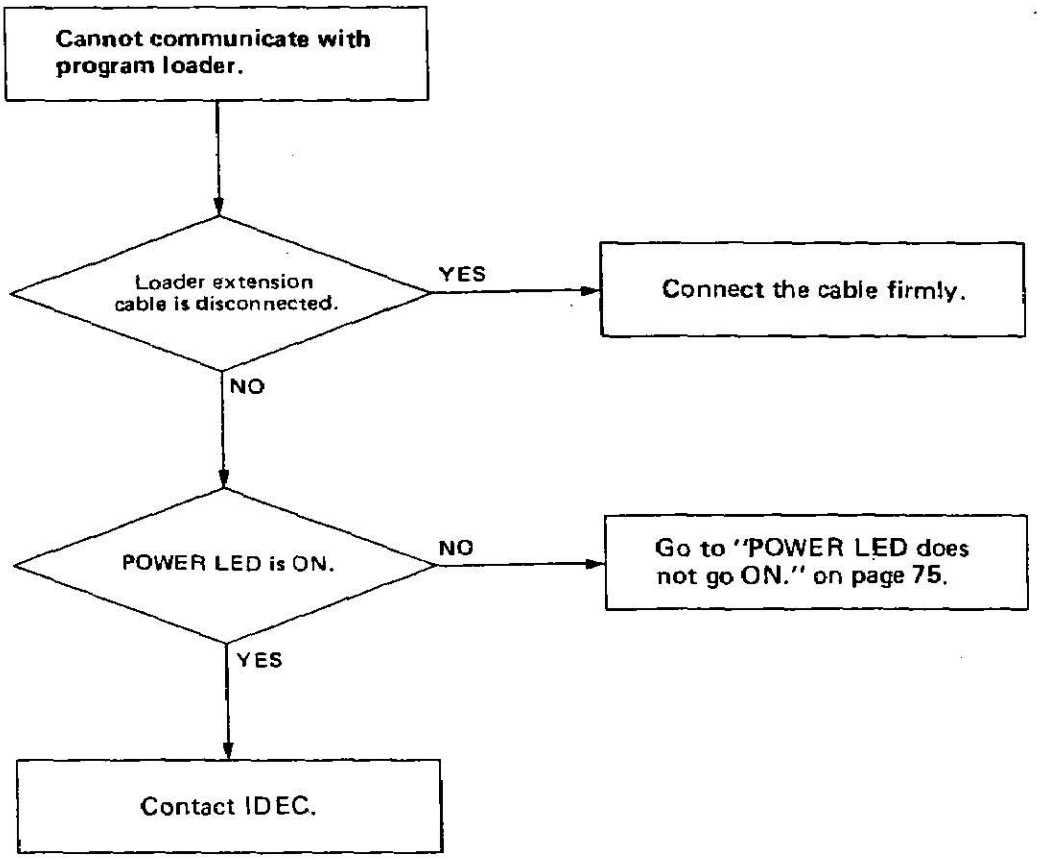
*If the RUN LED is turned on by turning the IR701 OFF, the RUN/STOP switch on the MICRO-1 program loader may be defective, then contact IDEC.

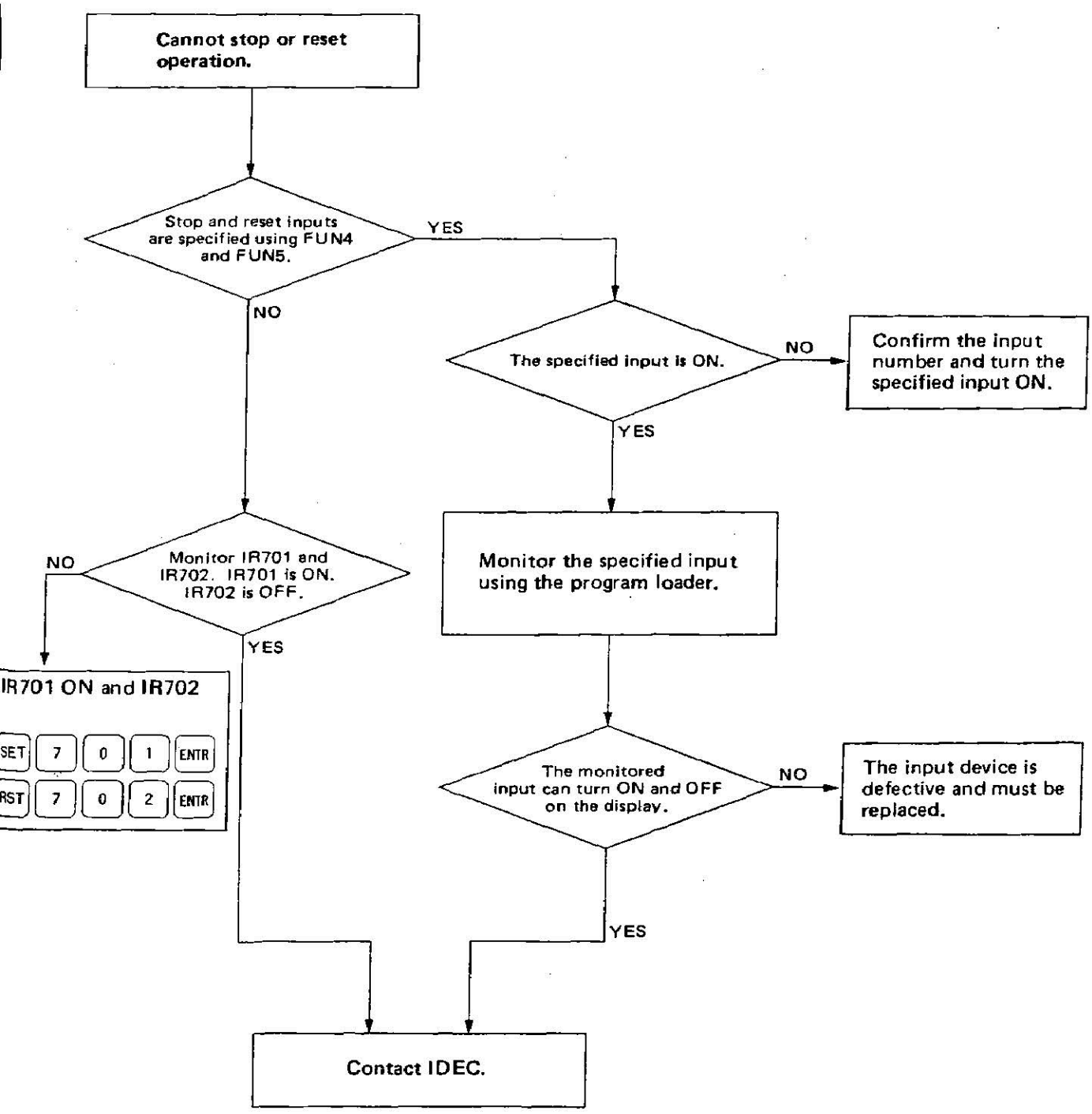


See DIAGNOSTIC FUNCTIONS & MAINTENANCE on page 70.


Input does not operate normally.
Input LED is ON.
NO
●Check input wiring.
●Check input switches.
●Check input ON/OFF voltages.
YES
Check input allocation numbers.
Input operates normally.
YES
NO
Input allocation numbers are correct.
NO
Correct the program.
YES
Contact IDEC.
End


Output does not operate normally.
Output LED is ON.
YES
Check the output wiring.
NO
Check the output allocation number.
The output allocation number is correct.
NO
Correct the program.
YES
Monitor the output on the program loader.
MON
Output No.
READ
See MONITORING OPERATION on page 61.
The monitored output turns ON and OFF on the display.
YES
•The output relay in the base or expansion unit is defective.
•The serial I/O module or serial I/O cable is defective.
NO
Contact IDEC.
End


Cannot communicate with program loader.
Loader extension cable is disconnected.
YES
Connect the cable firmly.
NO
POWER LED is ON.
NO
Go to "POWER LED does not go ON." on page 75.
YES
Contact IDEC.


Cannot stop or reset operation.
Stop and reset inputs are specified using FUN4 and FUN5.
YES
NO
The specified input is ON.
NO
Confirm the input number and turn the specified input ON.
YES
Monitor IR701 and IR702. IR701 is ON. IR702 is OFF.
NO
YES
Monitor the specified input using the program loader.
IR701 ON and IR702
SET 7 0 1 ENTR
RST 7 0 2 ENTR
The monitored input can turn ON and OFF on the display.
NO
The input device is defective and must be replaced.
YES
Contact IDEC.

TYPE LIST

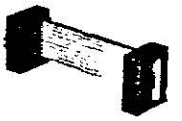
Name				Type No.	Remarks	
Base Unit	AC Type	Relay Output	Source Input	FC1A-C1A1E	Power voltage: 100-240V AC	Accepts NPN transistor inputs
			Sink Input	FC1A-C2A1E		Accepts PNP transistor inputs
		Transistor Output	Source Input Sink Output	FC1A-C1B1E		Accepts NPN transistor inputs Contains NPN transistor outputs
			Sink Input Source Output	FC1A-C2C1E		Accepts PNP transistor inputs Contains PNP transistor outputs
	DC Type	Relay Output	Source Input	FC1A-C1A4E	Power voltage: 24V DC	Accepts NPN transistor inputs
			Sink Input	FC1A-C2A4E		Accepts PNP transistor inputs
		Transistor Output	Source Input Sink Output	FC1A-C1B4E		Accepts NPN transistor inputs Contains NPN transistor outputs
			Sink Input Source Output	FC1A-C2C4E		Accepts PNP transistor inputs Contains PNP transistor outputs
		Relay Output	Source Input	FC1A-C1A2E	Power voltage: 12V DC	Accepts NPN transistor inputs
			Sink Input	FC1A-C2A2E		Accepts PNP transistor inputs
		Transistor Output	Source Input Sink Output	FC1A-C1B2E		Accepts NPN transistor inputs Contains NPN transistor outputs
			Sink Input Source Output	FC1A-C2C2E		Accepts PNP transistor inputs Contains PNP transistor outputs
Program Loader				FC1A-HL1E	24 keys, 16-character LCD	
Data Preset Loader			Standard	FC1A-PL1E	For changing timer/counter preset values and monitoring I/O, IR, timer, counter	
			Multi-function	FC1A-PL2E	For changing preset values, monitoring, direct set/reset, reading program, etc.	
Loader Extension Cable				FC1A-KL1	1.5m long, for connecting the program loader or data preset loader to the base unit	
				FC1A-KL2	70mm long curl cord (attached to the program loader or data preset loader) For connecting the program loader or data preset loader to the base unit	
				FC1A-KL3	1.5m long, for connecting the FA series program loader to the MICRO-1 base unit	
				FC1A-KL4	1.5m long, for connecting the MICRO-1 loader to the FA series CPU	
Expansion Unit	AC Type	Relay Output	Source Input	FC1A-E1A1E	Power voltage: 100-240V AC	Accepts NPN transistor inputs
			Sink Input	FC1A-E2A1E		Accepts PNP transistor inputs
		Transistor Output	Source Input Sink Output	FC1A-E1B1E		Accepts NPN transistor inputs Contains NPN transistor outputs
			Sink Input Source Output	FC1A-E2C1E		Accepts PNP transistor inputs Contains PNP transistor outputs
	DC Type	Relay Output	Source Input	FC1A-E1A4E	Power voltage: 24V DC	Accepts NPN transistor inputs
			Sink Input	FC1A-E2A4E		Accepts PNP transistor inputs
		Transistor Output	Source Input Sink Output	FC1A-E1B4E		Accepts NPN transistor inputs Contains NPN transistor outputs
			Sink Input Source Output	FC1A-E2C4E		Accepts PNP transistor inputs Contains PNP transistor outputs
		Relay Output	Source Input	FC1A-E1A2E	Power voltage: 12V DC	Accepts NPN transistor inputs
			Sink Input	FC1A-E2A2E		Accepts PNP transistor inputs
		Transistor Output	Source Input Sink Output	FC1A-E1B2E		Accepts NPN transistor inputs Contains NPN transistor outputs
			Sink Input Source Output	FC1A-E2C2E		Accepts PNP transistor inputs Contains PNP transistor outputs
I/O Expansion Cable				FC1A-KE1	40mm long (attached to the expansion or analog timer unit)	For connecting the expansion or analog timer unit to the base unit
				PFA-1A21	500mm long	
				PFA-1A22	750mm long	
				PFA-1A23	1m long	
Serial I/O Module				FC1A-SM1E	Allows for expansion of 8 inputs and 8 outputs using a serial cable	
Serial Cable				FC1A-KS1	1m long	For connecting the serial I/O module to the base unit (with a shield terminal on one end)
				FC1A-KS2	2m long	
				FC1A-KS3	3m long	

Name		Type No.	Remarks
4-point Input	Source Input	FC1A-M1XE	Accepts NPN transistor inputs
	Sink Input	FC1A-M2XE	Accepts PNP transistor inputs
3-point Output	Relay Output	FC1A-MXAE	Independent 1NO contact: 1 point, Common 1NO contact: 2 points
2-point Input 2-point Output	Source Input Sink Output	FC1A-M1BE	Accepts NPN transistor inputs Contains NPN transistor outputs
	Sink Input Source Output	FC1A-M2CE	Accepts PNP transistor inputs Contains PNP transistor outputs
Micro Expansion Cable		FC1A-KM1	500mm long — For connecting a micro expansion unit to the base unit mounted separately.
		FC1A-KM2	1m long
Analog Timer Unit		FC1A-TA1	Contains four analog timers (eight time ranges from 1 sec to 10 min)
Digital Display Mother Board		FC1A-PD1	For DD33 — PC board for mounting a serial I/O module and four IDEC's DD series digital display units
		FC1A-PD2	For DD48
Fiber Link Unit		PFJ-U11	Interface between the IBM PC and MICRO-1 base units using an optical fiber for 1:N communication
Fiber Link Main Unit		PFJ-U12	
Cable Link Unit		PFJ-U21	Interface between the IBM PC and MICRO-1 base units using a 4-core twisted pair cable (RS-422) for 1:N communication
Cable Link Main Unit		PFJ-U22	
Link Adapter		PF2-CLA	Interface between the IBM PC and MICRO-1 base unit for 1:1 communication
FC Link Cable		FC1A-KC1	150mm curl cord For connecting the MICRO-1 base unit to the PFJ-U11, PFJ-U21 or PF2-CLA
Computer Link Cable		PFA-1A54	2m long, for connecting the IBM PC to the PFJ-U12, PFJ-U22 or PF2-CLA
DIN Rail Mount Power Supply Unit		PSR-AD0712E	Output: 12V DC, 0.6A — For supplying power to 3-wire sensors used with MICRO-1
		PSR-AD0724E	Output: 24V DC, 0.32A
DIN Rail		BAA500	500mm long — 35mm-wide DIN rail for mounting the base, expansion, micro expansion, analog timer or DIN rail mount power supply unit
		BAA1000	1000mm long
Mounting Clip		BNL5	Used at both ends of the MICRO-1 base/expansion and other units mounted on a DIN rail to prevent the unit from moving sideways
CUP (Control Logic Input Program)		PF9Y-LP2E	Ladder input program and monitor program for use on an IBM personal computer or compatible (3.5-inch diskettes)

For details of the Serial I/O Module, see Users Manual EM230.
For details of the Data Preset Loader and Analog Timer Unit, see Users Manual EM251.
For details of the Micro Expansion Units, see Catalog EP589.

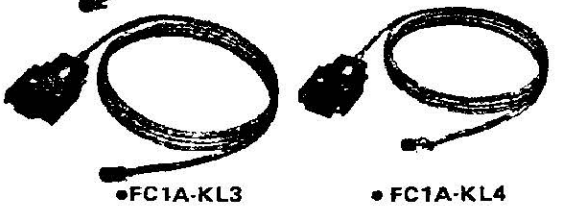
Optional Units and Accessories

Serial I/O Module
FC1A-SM1E

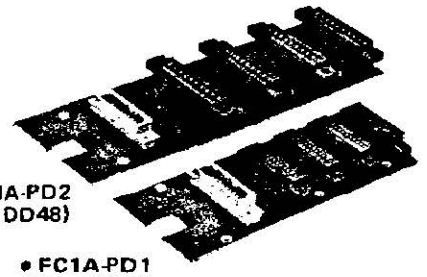


I/O Expansion Cable
• FC1A-KE1 (40mm long)
(attached to expansion unit)

• FC1A-KL2
(attached to program loader)

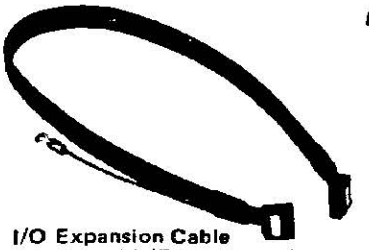


•FC1A-KL3 • FC1A-KL4
Loader Extension Cable



FC1A-PD2
(For DD48)

• FC1A-PD1
(For DD33)
Digital Display Mother Board



I/O Expansion Cable
• PFA-1A21 (500mm long)
• PFA-1A22 (750mm long)
• PFA-1A23 (1m long)
Serial Cable
• FC1A-KS1 (1m long)
• FC1A-KS2 (2m long)
• FC1A-KS3 (3m long)

FC Link Cable
• FC1A-KC1

Note: I/O expansion cables PFA-1A21, PFA-1A22, and PFA-1A23 are identical in shape with serial cables except length. The shield terminal on the I/O expansion cables need not be connected to any terminal. See page 67.

PROGRAM KEY OPERATING PROCEDURES

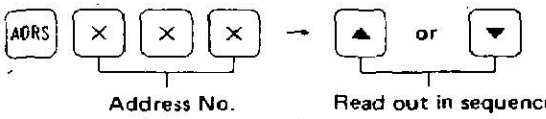
Clear User Memory

The entire user program memory in the program loader is cleared.

DELT END ENTR

Select Program Address

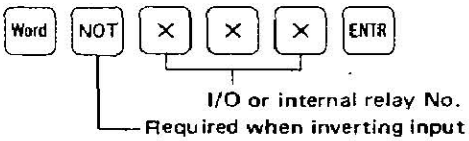
A program address can be selected either during operation or halt.



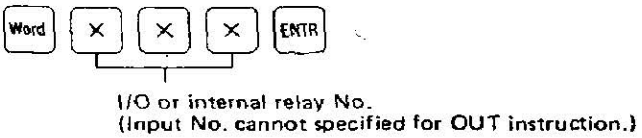
Enter Program Instruction

After program instructions have been entered, they can be changed by superimposing new program instructions.

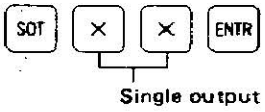
1. LOD, AND, or OR Instruction



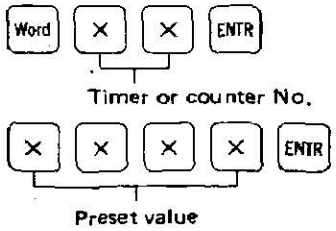
2. OUT, SET, or RST Instruction



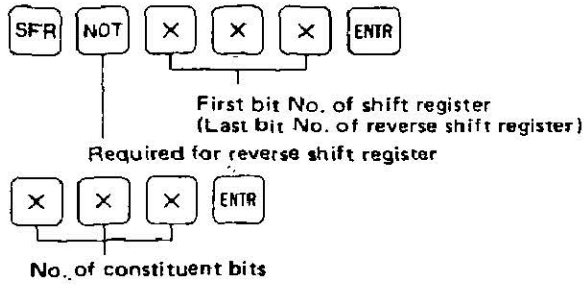
3. SOT Instruction



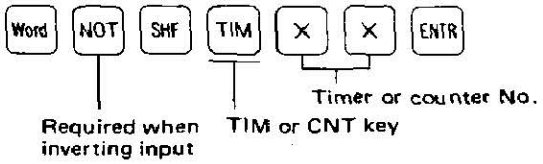
4. TIM or CNT Instruction



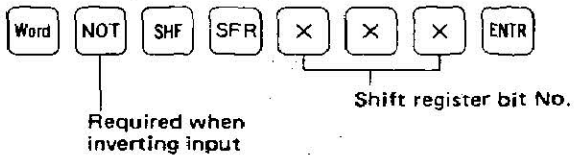
5. SFR Instruction



6. LOD TIM, AND TIM, OR TIM, LOD CNT, AND CNT, or OR CNT Instruction



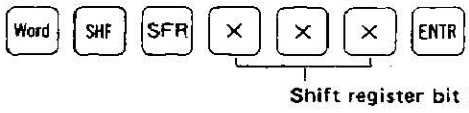
7. LOD SFR, AND SFR, or OR SFR Instruction



8. AND LOD or OR LOD Instruction

Word SHF LOD ENTR

9. SET SFR or RST SFR Instruction



10. MCS or MCR Instruction

MCS/MCR ENTR (MCS)

MCS/MCR MCS/MCR ENTR (MCR)

Note: The MCS/MCR key alternates MCS and MCR instructions each time pressed.

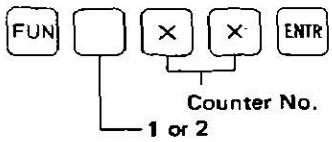
11. JMP or JEND Instruction

JMP/JEND ENTR (JMP)

JMP/JEND JMP/JEND ENTR (JEND)

Note: The JMP/JEND key alternates JMP and JEND instructions each time pressed.

12. FUN100 to FUN146 or FUN200 to FUN246 Instruction



13. END Instruction

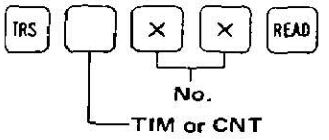
END ENTR

Note: Word denotes an instruction word key such as LOD, AND, OR, OUT, SET, RST, TIM or CNT key.

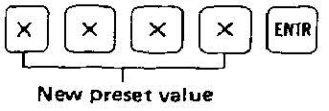
Change Timer/Counter Preset Values during Operation

Timer or counter preset values can be changed either during operation or halt.

1. Read out the timer or counter number.



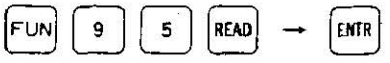
2. Enter a new preset value



Preset values stored in the base unit user program memory are not changed by the above procedures 1 and 2.

3. Restore preset values

After changing a preset value, the new preset value can be cleared and the old value can be restored.

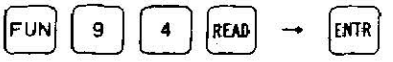


When this procedure is completed, all timer/counter preset values return to the original values.

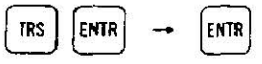
4. Enter the new timer/counter preset values to the user memory in the base unit.

1) Stop operation

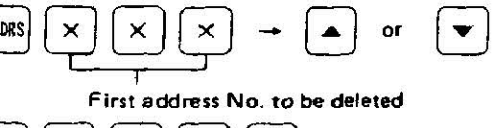
2) Transfer the new preset value data and program from the base unit RAM to the program loader.

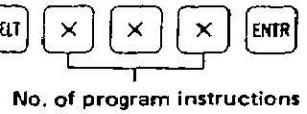


3) Transfer the new preset value from the program loader to the base unit user memory (EEPROM).



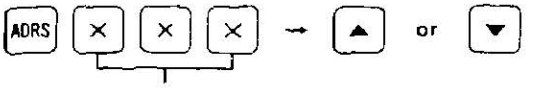
Delete Program Instructions





The subsequent program instructions are shifted up.

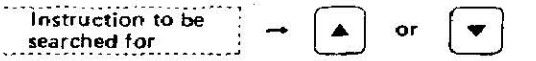
Insert Program Instruction



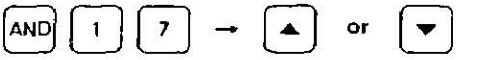
The subsequent program instructions are shifted down by one step.

Search for Program Instruction

An instruction and its address can be searched for and displayed.



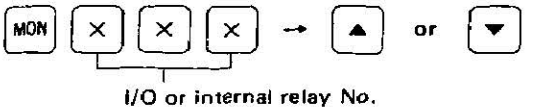
[Ex.] To search for AND17



Searching is started from the step next to the currently displayed step. When the required instruction is located, the instruction and its address are displayed.

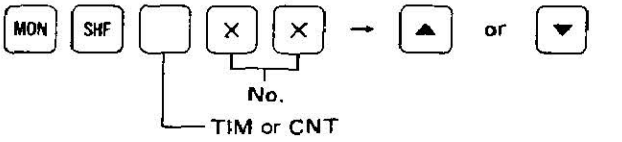
Monitoring

1. Monitoring I/O or Internal Relays



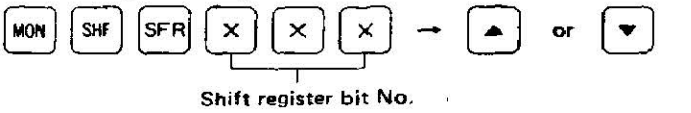
Eight points are displayed at one time from the displayed address included, with ■ for ON or □ for OFF.

2. Monitoring Timer Current Value or Counter Counted Value



Timers operate in the subtracting mode and counters in the adding mode. The monitored timer current value or counter counted value is displayed, with ■ when the preset value is reached or □ during operation.

3. Monitoring Shift Register



Eight bits from the displayed bit number are displayed, with ■ for ON or □ for OFF.
Pressing the ▲ or ▼ key will display the preceding or subsequent eight bits. To cancel monitoring, press the CLR key. Monitored data is renewed every 100 msec.

Transfer Programs between Loader and Base Unit

1. Transfer from The Program Loader to The Base Unit

[TRS] [ENTR]

When "TRS L T P GO?" is displayed, make sure the base unit is in halt. To continue, press the ENTR key. "TRS L T P" is displayed during execution. When completed, "TRS L T P END" is displayed.

2. Transfer from The Base Unit to The Program Loader

[TRS] [READ]

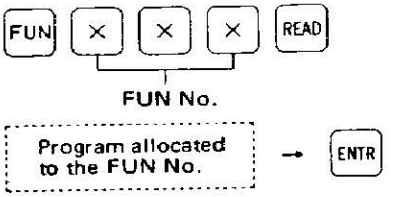
"TRS P T L GO?" is displayed. To continue, press the ENTR key. "TRS P T L" is displayed during execution. When completed, "TRS P T L END" is displayed.

3. Verification between The Base Unit and The Program Loader

[TRS] [VERI]

"TRS L A P GO?" is displayed. To continue, press the ENTR key. "TRS L A P" is displayed during execution. When completed, "TRS L A P END" is displayed.

FUN (Function) Operation



MICRO-1 PROGRAMMING SHEET

Sheet No. _____ of _____

Step (Address)	Instruction Word	Number Data	Remarks	Step (Address)	Instruction Word	Number Data	Remarks
0				50			
1				51			
2				52			
3				53			
4				54			
5				55			
6				56			
7				57			
8				58			
9				59			
10				60			
11				61			
12				62			
13				63			
14				64			
15				65			
16				66			
17				67			
18				68			
19				69			
20				70			
21				71			
22				72			
23				73			
24				74			
25				75			
26				76			
27				77			
28				78			
29				79			
30				80			
31				81			
32				82			
33				83			
34				84			
35				85			
36				86			
37				87			
38				88			
39				89			
40				90			
41				91			
42				92			
43				93			
44				94			
45				95			
46				96			
47				97			
48				98			
49				99			

Title				Approved by	Checked by	Designed by
Program Name						
Data		Dwg. No.				

Allocation Table

No.	Symbol Description	Remarks	No.	Symbol Description	Remarks
0			0		
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
0			0		
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
0			0		
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
0			0		
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		

Approved by
Checked by
Designed by