



# **78K0R/Kx3 Microcontroller Sample Program Operation Manual**

**(3-Wire Serial I/O Processing (Master Transmission/Reception,  
Continuous Transmission/Reception Mode) (Serial Array Unit), C Source)**

---

This software is for reference only and NEC Electronics does not guarantee its operation.  
Thoroughly evaluate this software on your set prior to use.

ZUD-CC-07-0213-E  
January, 2008

1st Product Solution Group, Multipurpose Microcomputer Systems Division,  
Microcomputer Operations Unit  
NEC Electronics Corporation

- **The information in this document is current as of January, 2008. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".  
The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.  
"Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.  
"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).  
"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

- (1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

## CONTENTS

1. OVERVIEW.....	4
2. RESOURCES USED .....	5
3. SOFTWARE CONFIGURATION.....	6
4. FUNCTION EXPLANATIONS .....	7
5. FLOWCHARTS.....	10

## 1. OVERVIEW

This manual explains the sample program functions of 3-wire serial I/O processing (master transmission/reception (continuous transmission/reception mode)) for the 78K0R/Kx3.

In this sample program, master transmission/reception (continuous transmission/reception) operation in 3-wire serial I/O communication is performed.

The communication conditions are as follows.

- $f_{CLK} = 20 \text{ MHz}$
- CSI00 (unit 0, channel 0) is used.
- 9,600 bps, 8-bit data
- Data phase: Normal
- Clock phase: Normal
- LSB first
- Transmit data: 3AH (10 bytes)
- Receive data: 10 bytes
- INTCSI00 buffer empty interrupt servicing is used.

## 2. RESOURCES USED

Resource	Description	Remark
Main clock specification	Internal high-speed oscillator used (8 MHz (TYP.))	Always oscillated
	High-speed system clock used (20 MHz)	Oscillated by initial processing. Supplied to CPU and peripheral hardware
Subclock	XT1 (32.768 kHz)	Oscillated by initial processing
Related hardware	Peripheral enable register 0 (PER0)	
	Serial clock select register 0 (SPS0)	Clock used: CK00 (1/2 <sup>4</sup> of main clock), 1.25 MHz (0.8 μs)
	Serial mode register 00 (SMR00)	
	Serial communication operation setting register 00 (SCR00)	Transmission/reception, data length: 8 bits
	Serial data register 00 (SDR00)	Transfer rate: 9,600 bps
	Serial flag clear trigger register 00 (SIR00)	Used to clear an error flag.
	Serial channel start register 0 (SS0)	
	Serial channel stop register 0 (ST0)	
	Serial output register 0 (SO0)	
	Serial output enable register 0 (SOE0)	
	Port mode register 1 (PM1)	
	Port register 1 (P1)	
	SIO00 register (SIO00)	Used to write transmit data.
I/O	Data input: SI00 (P11) Data output: SO00 (P12) Clock output: SCK00 (P10)	
Interrupt	Transfer end interrupt (INTCSI00) of CSI00	
Others	Not used	

### 3. SOFTWARE CONFIGURATION

#### Files

File Name	Processing Outline	Remark
K0R_def.h	Definition file	
K0R_init.c <sup>Note</sup>	Initialization processing	
K0R_ext.h	External declaration	
K0R_main.c	Main processing	
K0R_sfr_set.c	3-wire serial I/O processing Master transmission/reception (continuous transmission/reception mode)	

**Note** This file is commonly used by the sample programs.

#### 4. FUNCTION EXPLANATIONS

[File name]

K0R\_main.c

Function

Function Name	Processing Outline	Argument	Return Value
main	Main routine	None	None

Function explanations

Function name	main
Processing	Main routine
Argument	–
Return value	–
Description	Executes initialization processing and then starts transmission/reception operation. Aborts the operation after reception completion and then resumes the operation.
Remark	–

[File name]

K0R\_sfr\_set.c

Functions

Function Name	Processing Outline	Argument	Return Value
SER_MTRCIN	Initializes 3-wire serial I/O.	None	None
SER_MTRCST	Starts 3-wire serial I/O operation.	None	None
SER_MTRCBK	Aborts 3-wire serial I/O operation.	None	None
SER_MTRCRE	Resumes 3-wire serial I/O operation.	None	None
SER_MTRCSP	Stops 3-wire serial I/O operation.	None	None
SER_MTRCIT	INTCSI00 buffer empty interrupt/transfer end interrupt servicing	None	None

## Function explanations

Function name	SER_MTRCIN
Processing	Initializes 3-wire serial I/O.
Argument	–
Return value	–
Description	Executes initialization.
Remark	–

Function name	SER_MTRCST
Processing	Starts 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Starts transmission/reception operation.
Remark	–

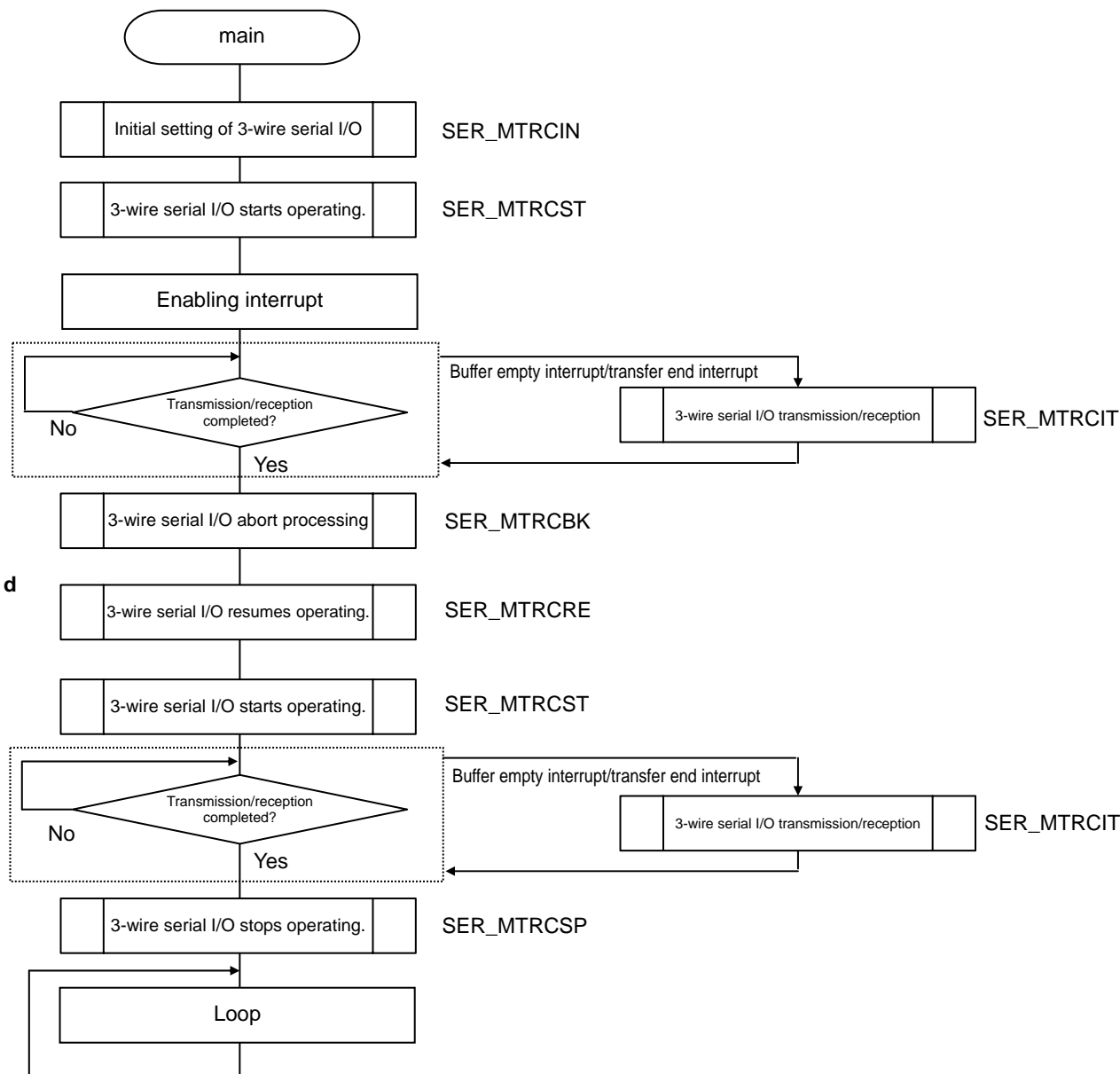
Function name	SER_MTRCBK
Processing	Aborts 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Transits to a communication operation stop state.
Remark	–

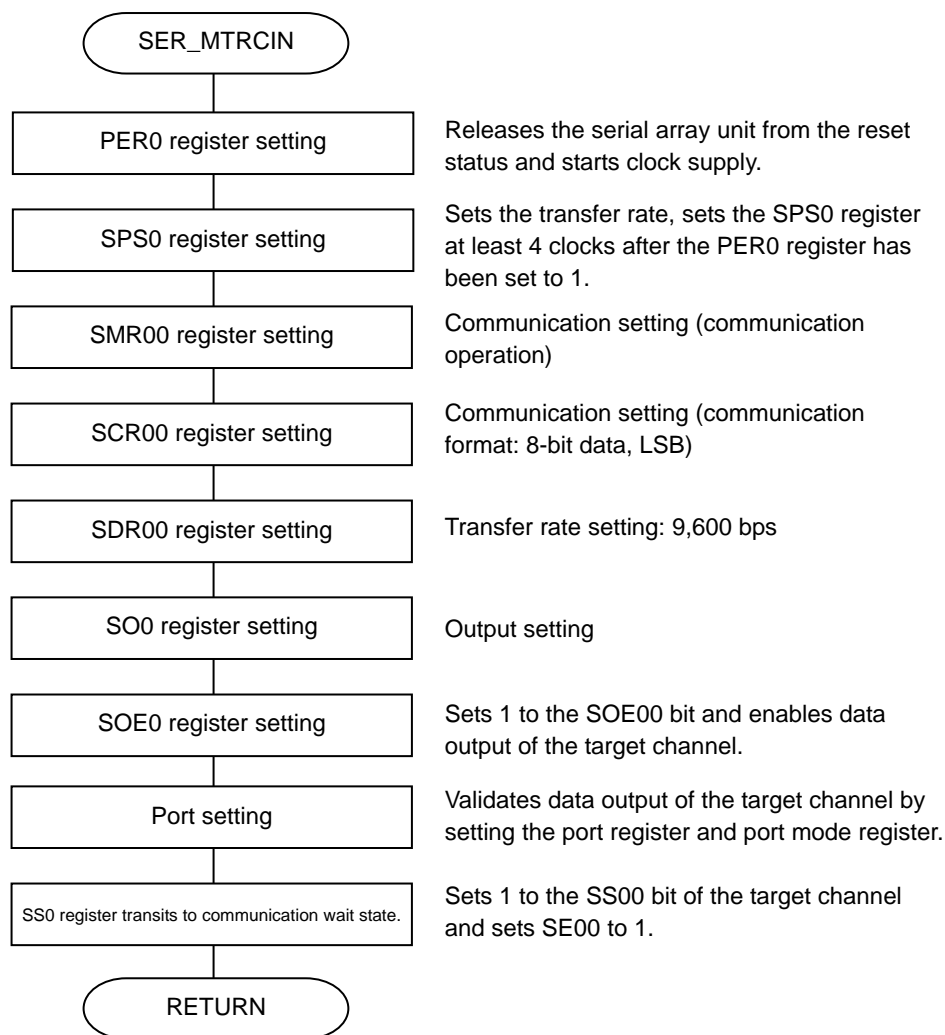
Function name	SER_MTRCRE
Processing	Resumes 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Resumes transmission/reception operation.
Remark	–

Function name	SER_MTRCSP
Processing	Stops 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Stops clock supply.
Remark	–

Function name	SER_MTRCIT
Processing	3-wire serial I/O transmission/reception
Argument	–
Return value	–
Description	<p>INTCSI00 buffer empty interrupt/transfer end interrupt servicing</p> <p>An interrupt is generated when a buffer empty interrupt is generated.</p> <p>When this interrupt is generated, the receive data is read and transmit data is set.</p> <p>When reception is completed, transfer is completed and processing is terminated.</p>
Remark	–

5. FLOWCHARTS





Releases the serial array unit from the reset status and starts clock supply.

Sets the transfer rate, sets the SPS0 register at least 4 clocks after the PER0 register has been set to 1.

Communication setting (communication operation)

Communication setting (communication format: 8-bit data, LSB)

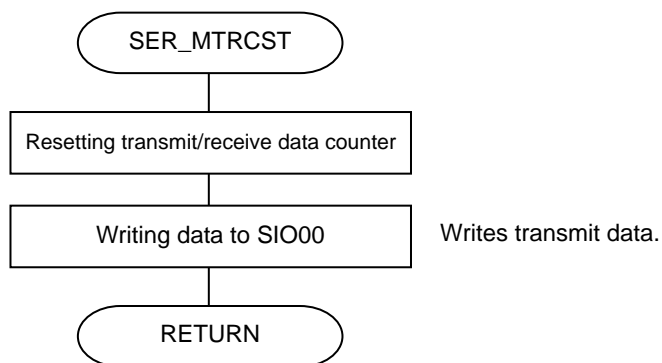
Transfer rate setting: 9,600 bps

Output setting

Sets 1 to the SOE00 bit and enables data output of the target channel.

Validates data output of the target channel by setting the port register and port mode register.

Sets 1 to the SS00 bit of the target channel and sets SE00 to 1.



Writes transmit data.

