

# DKBLUPF90 Installation Guide

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## System Requirements

### Minimum Requirements

- **Operating System:** Linux (Ubuntu 18.04+, CentOS 7+, RHEL 7+, Debian 10+)
- **Compiler:** gfortran 4.8 or higher
- **Build Tools:** make, ar (binutils)
- **Disk Space:** 100 MB (source + binaries)
- **Memory:** 4 GB RAM

### Recommended Requirements

- **Operating System:** Ubuntu 20.04 LTS or newer
- **Compiler:** gfortran 9.0 or higher
- **Disk Space:** 500 MB (including test data)
- **Memory:** 8 GB RAM or more (for large datasets)

## Dependencies

### Required

*# Ubuntu/Debian*

```
sudo apt-get install build-essential gfortran make
```

*# CentOS/RHEL/Fedora*

```
sudo yum install gcc gcc-gfortran make binutils
```

### Optional (for documentation)

*# Ubuntu/Debian*

```
sudo apt-get install pandoc texlive-xetex texlive-latex-extra
```

```
# CentOS/RHEL/Fedora
sudo yum install pandoc texlive-xetex texlive-latex
```

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## Pre-Installation Checklist

### 1. Check gfortran Installation

```
gfortran --version
# Output should show version 4.8 or higher
```

### 2. Verify Build Tools

```
make --version
ar --version
```

### 3. Check Available Disk Space

```
df -h /usr/local  # For system-wide installation
df -h $HOME        # For user installation
```

### 4. Prepare Installation Directory

```
# For user installation (recommended for non-admin users)
mkdir -p ~/.local/bin
mkdir -p ~/.local/lib
mkdir -p ~/.local/include
```

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## Installation Methods

### Method 1: Automatic Installation (Recommended)

#### System-Wide Installation (requires root)

```
cd /home/your_user/DKBLUPF90
sudo ./install.sh
```

**Installation Locations:** - Libraries: /usr/local/lib/libdkblupf90.so\* - Binaries: /usr/local/bin/ReadFR - Headers: /usr/local/include/dkblupf90/ - Examples: /usr/local/share/dkblupf90/

#### User Directory Installation (no root required)

```
cd /home/your_user/DKBLUPF90
PREFIX=$HOME/.local ./install.sh
```

**Installation Locations:** - Libraries: ~/.local/lib/libdkblupf90.so\* - Binaries: ~/.local/bin/ReadFR - Headers: ~/.local/include/dkblupf90/

**Add to PATH:**

```
# Add to ~/.bashrc or ~/.zshrc
export PATH="$HOME/.local/bin:$PATH"
export LD_LIBRARY_PATH="$HOME/.local/lib:$LD_LIBRARY_PATH"

# Apply changes
source ~/.bashrc
```

## Method 2: Manual Installation

### Build Library

```
cd /home/your_user/DKBLUPF90
make clean      # Clean previous builds
make lib        # Build shared library
```

### Build ReadFR Program

```
make readfr     # Build ReadFR
```

### Install to Standard Location

```
# Create installation directory
sudo mkdir -p /usr/local/lib /usr/local/bin /usr/local/include/dkblupf90

# Copy library
sudo cp lib/libdkblupf90.so* /usr/local/lib/

# Copy binary
sudo cp bin/ReadFR /usr/local/bin/

# Copy headers/modules
sudo cp include/*.mod /usr/local/include/dkblupf90/

# Update library cache
sudo ldconfig
```

### Install to User Directory

```
# Create installation directory
mkdir -p $HOME/.local/lib $HOME/.local/bin $HOME/.local/include/dkblupf90

# Copy files
cp lib/libdkblupf90.so* $HOME/.local/lib/
cp bin/ReadFR $HOME/.local/bin/
cp include/*.mod $HOME/.local/include/dkblupf90/

# Update PATH and LD_LIBRARY_PATH in ~/.bashrc
echo 'export PATH="$HOME/.local/bin:$PATH"' >> ~/.bashrc
echo 'export LD_LIBRARY_PATH="$HOME/.local/lib:$LD_LIBRARY_PATH"' >> ~/.bashrc
source ~/.bashrc
```

### Method 3: Docker Installation (Optional)

```
FROM ubuntu:20.04
RUN apt-get update && apt-get install -y build-essential gfortran make
WORKDIR /tmp
COPY DKBLUPF90 /tmp/DKBLUPF90
WORKDIR /tmp/DKBLUPF90
RUN sudo ./install.sh
ENTRYPOINT ["ReadFR"]
```

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### Post-Installation Verification

#### 1. Verify Installation Locations

```
# Check binary
which ReadFR
ReadFR --version 2>&1 | head -1
```

```
# Check library
ldconfig -p | grep libdkblupf90
```

#### 2. Validate Binary Functionality

```
cd /usr/local/share/dkblupf90/examples # or copy examples to working dir
ReadFR parameter
```

```
# Check output file
ls -lh GENO_QC_*.geno
```

#### 3. Run Test Suite

```
cd /home/your_user/DKBLUPF90
make test
```

#### 4. Troubleshoot Library Loading

```
# Check library dependency
ldd /usr/local/bin/ReadFR

# Set library path if needed
export LD_LIBRARY_PATH=/usr/local/lib:$LD_LIBRARY_PATH
ReadFR parameter
```

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## Troubleshooting

### Issue 1: “gfortran: command not found”

```
# Ubuntu/Debian  
sudo apt-get install gfortran
```

```
# CentOS/RHEL  
sudo yum install gcc-gfortran
```

### Issue 2: “libdtkblupf90.so: cannot open shared object file”

```
# Add library path  
export LD_LIBRARY_PATH=/usr/local/lib:$LD_LIBRARY_PATH  
  
# Or make it permanent (add to ~/.bashrc)  
echo 'export LD_LIBRARY_PATH=/usr/local/lib:$LD_LIBRARY_PATH' >> ~/.bashrc  
source ~/.bashrc  
  
# Update library cache  
sudo ldconfig
```

### Issue 3: “Permission denied” during installation

```
# Use sudo for system-wide installation  
sudo ./install.sh  
  
# Or use user directory installation  
PREFIX=$HOME/.local ./install.sh
```

### Issue 4: Compilation errors

```
# Check gfortran version  
gfortran --version  
  
# Ensure minimum version 4.8  
# If version is too old, update:  
# Ubuntu/Debian  
sudo apt-get install gfortran-9  
  
# CentOS/RHEL  
sudo yum install devtoolset-9-gcc-gfortran  
scl enable devtoolset-9 bash
```

### Issue 5: “segmentation fault” or runtime errors

```
# Rebuild with debug symbols  
make clean  
CFLAGS="-g -O0" make lib  
make readfr
```

```
# Run with gdb
gdb --args ReadFR parameter
(gdb) run
```

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## Uninstallation

### System-Wide Installation

```
# Remove binary
sudo rm /usr/local/bin/ReadFR

# Remove library
sudo rm /usr/local/lib/libdkblupf90.so*

# Remove headers
sudo rm -rf /usr/local/include/dkblupf90

# Remove examples
sudo rm -rf /usr/local/share/dkblupf90

# Update library cache
sudo ldconfig
```

### User Directory Installation

```
# Remove binary
rm ~/.local/bin/ReadFR

# Remove library
rm ~/.local/lib/libdkblupf90.so*

# Remove headers
rm -rf ~/.local/include/dkblupf90
```

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## Environment Variables

### Recommended Settings

```
# Add to ~/.bashrc or ~/.bash_profile
export DKBLUPF90_HOME=/usr/local # or $HOME/.local for user installation
export PATH="$DKBLUPF90_HOME/bin:$PATH"
export LD_LIBRARY_PATH="$DKBLUPF90_HOME/lib:$LD_LIBRARY_PATH"
export FFLAGS="-O2 -fPIC"
```

## Verification

```
# Test environment variables  
echo $DKBLUPF90_HOME  
echo $LD_LIBRARY_PATH  
which ReadFR
```

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## Support and Feedback

For installation issues or feedback: - **Email:** dhlee@hknu.ac.kr - **Organization:** Hankyong National University - **Department:** Department of Animal Science

## Reporting Installation Issues

When reporting issues, please provide: 1. Operating system (output of `uname -a`) 2. gfortran version (output of `gfortran --version`) 3. Error messages (complete output) 4. Installation method used 5. Installation directory chosen

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## License

DKBLUPF90 is released under the MIT License. See LICENSE file for details.

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## End of Installation Guide

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